IJESRT: 12(8), August, 2023 ISSN: 2277-9655

International Journal of Engineering Sciences & Research Technology

(A Peer Reviewed Online Journal)
Impact Factor: 5.164

IJESRT

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

DOMINATION ATOM BOND SUM CONNECTIVITY INDICES OF CERTAIN NANOSTRUCTURES

V.R.Kulli
Department of Mathematics Gulbarga University, Gulbarga 585106, India

DOI: 10.5281/zenodo.8310981

ABSTRACT
In this paper, we introduce the domination atom bond sum connectivity index, multiplicative domination atom bond sum connectivity index and domination atom bond sum connectivity exponential of a graph. Also we determine these newly defined domination atom bond sum connectivity indices for some chemical drugs such as chloroquine and hydroxychloroquine.

Keywords: domination atom bond sum connectivity index, multiplicative domination atom bond sum connectivity index, drug.

Mathematics Subject Classification: 05C10, 05C69.

1. INTRODUCTION
Let $G = (V, E)$ be a finite, simple connected graph. Let $d_G(u)$ denote the degree of a vertex u in a graph G. For undefined terms and notations, we refer [1, 2].

In the modeling of Mathematics, a molecular or a chemical graph is a simple graph related to the structure of a chemical compound. Each vertex of this graph represents an atom of the molecule and its edges to the bonds between atoms. Topological indices are useful for finding correlations between the structure of a chemical compound and its physicochemical properties. Numerous topological indices have been considered in Theoretical Chemistry and have found some applications, especially in QSPR/QSAR research, see [3, 4].

In [5], the domination atom bond sum connectivity index of a graph G is defined as

$$DABC(G) = \sum_{uv\in E(G)} \sqrt{\frac{d_d(u)+d_d(v)-2}{d_d(u)d_d(v)}}.$$

Very recently, some domination indices have been researched in [6, 7, 8, 9, 10, 11, 12] and some atom bond connectivity indices studied in [13, 14, 15].

We introduce the domination atom bond sum connectivity index of a graph G, defined as

$$DABS(G) = \sum_{uv\in E(G)} \sqrt{\frac{d_d(u)+d_d(v)-2}{d_d(u)+d_d(v)}}.$$

Considering the domination atom bond sum connectivity index, we define the domination atom bond sum connectivity exponential of a graph as

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

$$DABS(G,x)=\sum_{uv\in E(G)} x^{\sqrt{\frac{d_d(u)+d_d(v)-2}{d_d(u)+d_d(v)}}}.$$

We define the multiplicative domination atom bond sum connectivity index of a graph as

$$DABSII(G)=\prod_{uv\in E(G)}\sqrt{\frac{d_d(u)+d_d(v)-2}{d_d(u)+d_d(v)}}.$$

Recently, some domination parameters were studied, for example, in [16, 17, 18, 19, 20, 21, 22, 23, 24, 25].

In this paper, we compute the domination atom bond sum connectivity index and multiplicative domination atom bond sum connectivity index of chloroquine and hydroxychloroquine.

2. RESULTS FOR CHLOROQUINE

Chloroquine is an antiviral chemical compound (drug). This drug was discovered in 1934 by Andersag. This drug is medication primarily used to prevent and treat malaria.

Let G be the chemical structure of chloroquine. This structure has 21 vertices and 23 edges, see Figure 1.

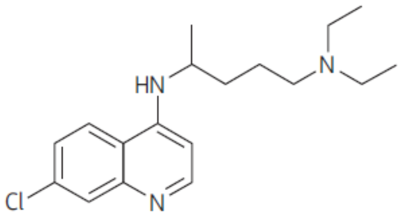

Figure 1. Chemical structure of chloroquine

From Figure 1, we obtain that $\{(d_d(u), d_d(v)) \setminus uv\in E(G)\}$ has 16 edge set partitions.
Table 1. [26] Edge partition based on the domination degree of end vertices of each edge of chloroquine.

Table 1. Edge set partitions of chloroquine

$d_d(u), d_d(v) \setminus uv\in E(G)$	(216,288)	(216,264)	(216,216)	(324,324)	(297,324)
Number of edges	2	2	2	4	2
	(240,408)	(240,264)	(144,204)	(246,288)	(144,384)
	1	1	1	1	1
	(288,384)	(216,384)	(216,240)	(240,324)	(216,324)
	1	1	1	1	1
	(216,297)				
	1				

We calculate the domination atom bond sum connectivity index of chloroquine as follows:

Theorem 1. The domination atom bond sum connectivity index of chloroquine is given by

$$DABS(G) = 22.9567105385$$

Proof: Applying definition and edge partition of chloroquine, we conclude

$$DABS(G) = \sum_{uv \in E(G)} \sqrt{\frac{d_d(u)+d_d(v)-2}{d_d(u)+d_d(v)}}$$

$$= 2\left(\sqrt{\frac{216+288-2}{216+288}}\right) + 2\left(\sqrt{\frac{216+264-2}{216+264}}\right) + 2\left(\sqrt{\frac{216+216-2}{216+216}}\right) + 4\left(\sqrt{\frac{324+324-2}{324+324}}\right)$$
$$+2\left(\sqrt{\frac{297+324-2}{297+324}}\right) + 1\left(\sqrt{\frac{240+408-2}{240+408}}\right) + 1\left(\sqrt{\frac{240+264-2}{240+264}}\right) + 1\left(\sqrt{\frac{144+204-2}{144+204}}\right)$$
$$+1\left(\sqrt{\frac{246+288-2}{246+288}}\right) + 1\left(\sqrt{\frac{144+384-2}{144+384}}\right) + 1\left(\sqrt{\frac{288+384-2}{288+384}}\right) + 1\left(\sqrt{\frac{216+384-2}{216+384}}\right)$$
$$+1\left(\sqrt{\frac{216+240-2}{216+240}}\right) + 1\left(\sqrt{\frac{240+324-2}{240+324}}\right) + 1\left(\sqrt{\frac{216+324-2}{216+324}}\right) + 1\left(\sqrt{\frac{216+297-2}{216+297}}\right)$$
$$= 2\left(\sqrt{\frac{502}{504}}\right) + 2\left(\sqrt{\frac{478}{480}}\right) + 2\left(\sqrt{\frac{430}{432}}\right) + 4\left(\sqrt{\frac{646}{648}}\right) + 2\left(\sqrt{\frac{619}{621}}\right) + 1\left(\sqrt{\frac{646}{648}}\right)$$
$$+1\left(\sqrt{\frac{502}{504}}\right) + 1\left(\sqrt{\frac{346}{348}}\right) + 1\left(\sqrt{\frac{532}{534}}\right) + 1\left(\sqrt{\frac{526}{528}}\right) + 1\left(\sqrt{\frac{670}{672}}\right) + 1\left(\sqrt{\frac{598}{600}}\right)$$
$$+1\left(\sqrt{\frac{454}{456}}\right) + 1\left(\sqrt{\frac{562}{564}}\right) + 1\left(\sqrt{\frac{538}{540}}\right) + 1\left(\sqrt{\frac{511}{513}}\right).$$

By solving the above equation, we get the desired result.

We calculate the domination atom bond sum connectivity exponential of chloroquine as follows:

Theorem 2. The domination atom bond sum connectivity exponential of chloroquine is given by

$$DABS(G,x) = 3x^{\sqrt{\frac{251}{252}}} + 2x^{\sqrt{\frac{239}{240}}} + 2x^{\sqrt{\frac{215}{216}}} + 5x^{\sqrt{\frac{323}{324}}} + 2x^{\sqrt{\frac{619}{621}}} + x^{\sqrt{\frac{173}{174}}} + x^{\sqrt{\frac{266}{267}}}$$
$$+x^{\sqrt{\frac{263}{264}}} + x^{\sqrt{\frac{335}{336}}} + x^{\sqrt{\frac{299}{300}}} + x^{\sqrt{\frac{227}{228}}} + x^{\sqrt{\frac{281}{282}}} + x^{\sqrt{\frac{269}{270}}} + x^{\sqrt{\frac{511}{513}}}.$$

Proof: Applying definition and edge partition of chloroquine, we conclude

$$DABS(G,x) = \sum_{uv \in E(G)} x^{\sqrt{\frac{d_d(u)+d_d(v)-2}{d_d(u)+d_d(v)}}}$$

$$= 2x^{\sqrt{\frac{216+288-2}{216+288}}} + 2x^{\sqrt{\frac{216+264-2}{216+264}}} + 2x^{\sqrt{\frac{216+216-2}{216+216}}} + 4x^{\sqrt{\frac{324+324-2}{324+324}}}$$
$$+2x^{\sqrt{\frac{297+324-2}{297+324}}} + 1x^{\sqrt{\frac{240+408-2}{240+408}}} + 1x^{\sqrt{\frac{240+264-2}{240+264}}} + 1x^{\sqrt{\frac{144+204-2}{144+204}}}$$
$$+1x^{\sqrt{\frac{246+288-2}{246+288}}} + 1x^{\sqrt{\frac{144+384-2}{144+384}}} + 1x^{\sqrt{\frac{288+384-2}{288+384}}} + 1x^{\sqrt{\frac{216+384-2}{216+384}}}$$
$$+1x^{\sqrt{\frac{216+240-2}{216+240}}} + 1x^{\sqrt{\frac{240+324-2}{240+324}}} + 1x^{\sqrt{\frac{216+324-2}{216+324}}} + 1x^{\sqrt{\frac{216+297-2}{216+297}}}$$

By solving the above equation, we get the desired result.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

We calculate the multiplicative domination atom bond sum connectivity index of chloroquine as follows:

Theorem 3. The multiplicative domination atom bond sum connectivity index of chloroquine is given by

$$DABSII(G) = 0.95759388043$$

Proof: Applying definition and edge partition of chloroquine, we conclude

$$DABSII(G) = \prod_{uv \in E(G)} \sqrt{\frac{d_d(u)+d_d(v)-2}{d_d(u)+d_d(v)}}$$

$$= \left(\sqrt{\frac{216+288-2}{216+288}}\right)^2 \times \left(\sqrt{\frac{216+264-2}{216+264}}\right)^2 \times \left(\sqrt{\frac{216+216-2}{216+216}}\right)^2 \times \left(\sqrt{\frac{324+324-2}{324+324}}\right)^4$$

$$\times \left(\sqrt{\frac{297+324-2}{297+324}}\right)^2 \times \left(\sqrt{\frac{240+408-2}{240+408}}\right)^1 \times \left(\sqrt{\frac{240+264-2}{240+264}}\right)^1 \times \left(\sqrt{\frac{144+204-2}{144+204}}\right)^1$$

$$\times \left(\sqrt{\frac{246+288-2}{246+288}}\right)^1 \times \left(\sqrt{\frac{144+384-2}{144+384}}\right)^1 \times \left(\sqrt{\frac{288+384-2}{288+384}}\right)^1 \times \left(\sqrt{\frac{216+384-2}{216+384}}\right)^1$$

$$\times \left(\sqrt{\frac{216+240-2}{216+240}}\right)^1 \times \left(\sqrt{\frac{240+324-2}{240+324}}\right)^1 \times \left(\sqrt{\frac{216+324-2}{216+324}}\right)^1 \times \left(\sqrt{\frac{216+297-2}{216+297}}\right)^1$$

$$= \left(\sqrt{\frac{502}{504}}\right)^2 \times \left(\sqrt{\frac{478}{480}}\right)^2 \times \left(\sqrt{\frac{430}{432}}\right)^2 \times \left(\sqrt{\frac{646}{648}}\right)^4 \times \left(\sqrt{\frac{619}{621}}\right)^2 \times \left(\sqrt{\frac{646}{648}}\right)^1$$

$$\times \left(\sqrt{\frac{502}{504}}\right)^1 \times \left(\sqrt{\frac{346}{348}}\right)^1 \times \left(\sqrt{\frac{532}{534}}\right)^1 \times \left(\sqrt{\frac{526}{528}}\right)^1 \times \left(\sqrt{\frac{670}{672}}\right)^1 \times \left(\sqrt{\frac{598}{600}}\right)^1$$

$$\times \left(\sqrt{\frac{454}{456}}\right)^1 \times \left(\sqrt{\frac{562}{564}}\right)^1 \times \left(\sqrt{\frac{538}{540}}\right)^1 \times \left(\sqrt{\frac{511}{513}}\right)^1$$

By solving the above equation, we get the desired result.

3. RESULTS FOR HYDROXYCHLOROQUINE

Hydroxychloroquine is another antiviral compound (drug) which has antiviral activity very similar to that of chloroquine. These compounds have been repurposed for the treatment of a number of other conditions including HIV, systemic lupus erythmatosus and rheumatoid arthritis.

Let H be the chemical structure of hydroxychloroquine. This structure has 22 vertices and 24 edges, see Figure 2.

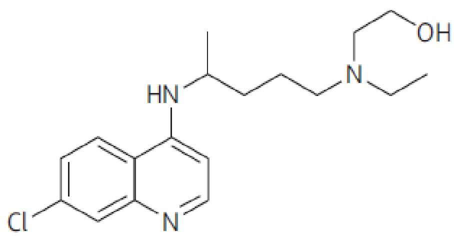

Figure 2. Chemical structure of hydroxychloroquine

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

From Figure 2, we obtain that $\{(d_d(u), d_d(v)) \setminus uv \in E(H)\}$ has 21 edge set partitions,

Table 2. [26] Edge partition based on the domination degree of end vertices of each edge of hydroxychloroquine

$d_d(u), d_d(v) \setminus uv\in E(H)$	(210,350)	(210,425)	(207,324)	(207,567)	(315,317)
Number of edges	1	1	1	1	1
	(315,385)	(315,420)	(315,425)	(317,340)	(317,385)
	1	2	1	1	1
	(324,324)	(324,459)	(324,567)	(324,621)	(340,486)
	1	1	1	1	1
	(350,385)	(350,595)	(385,420)	(420,425)	(459,486)
	1	1	1	1	3
	(486,567)				
	1				

We compute the domination atom bond sum connectivity index of hydroxychloroquine.

Theorem 4. The domination atom bond sum connectivity index of hydroxychloroquine is given by

$$DABS(H) = 23.9682324713$$

Proof: Applying definition and edge partition of hydroxychloroquine, we conclude

$$DABS(H) = \sum_{uv\in E(H)} \sqrt{\frac{d_d(u)+d_d(v)-2}{d_d(u)+d_d(v)}}$$

$$= 1\left(\sqrt{\frac{210+350-2}{210+350}}\right) + 1\left(\sqrt{\frac{210+425-2}{210+425}}\right) + 1\left(\sqrt{\frac{207+324-2}{207+324}}\right) + 1\left(\sqrt{\frac{207+567-2}{207+567}}\right)$$

$$+1\left(\sqrt{\frac{315+317-2}{315+317}}\right) + 1\left(\sqrt{\frac{315+385-2}{315+385}}\right) + 2\left(\sqrt{\frac{315+420-2}{315+420}}\right) + 1\left(\sqrt{\frac{315+425-2}{315+425}}\right)$$

$$+1\left(\sqrt{\frac{317+340-2}{317+340}}\right) + 1\left(\sqrt{\frac{317+385-2}{317+385}}\right) + 1\left(\sqrt{\frac{324+324-2}{324+324}}\right) + 1\left(\sqrt{\frac{324+459-2}{324+459}}\right)$$

$$+1\left(\sqrt{\frac{324+567-2}{324+567}}\right) + 1\left(\sqrt{\frac{324+621-2}{324+621}}\right) + 1\left(\sqrt{\frac{340+486-2}{340+486}}\right) + 1\left(\sqrt{\frac{350+385-2}{350+385}}\right)$$

$$+1\left(\sqrt{\frac{350+595-2}{350+595}}\right) + 1\left(\sqrt{\frac{385+420-2}{385+420}}\right) + 1\left(\sqrt{\frac{420+425-2}{420+425}}\right) + 3\left(\sqrt{\frac{459+486-2}{459+486}}\right)$$

$$+1\left(\sqrt{\frac{486+567-2}{486+567}}\right).$$

By solving the above equation, we get the desired result.

We compute the domination atom bond sum connectivity exponential of hydroxychloroquine.

Theorem 5. The domination atom bond sum connectivity exponential of hydroxychloroquine is given by

$$\begin{aligned}DABS(H,x)=&1x^{\sqrt{\frac{279}{280}}}+1x^{\sqrt{\frac{633}{635}}}+1x^{\sqrt{\frac{529}{531}}}+1x^{\sqrt{\frac{386}{387}}}+1x^{\sqrt{\frac{315}{316}}}+1x^{\sqrt{\frac{349}{350}}}\\&+2x^{\sqrt{\frac{733}{735}}}+1x^{\sqrt{\frac{369}{370}}}+1x^{\sqrt{\frac{655}{657}}}+1x^{\sqrt{\frac{350}{351}}}+1x^{\sqrt{\frac{323}{324}}}+1x^{\sqrt{\frac{781}{783}}}\\&+1x^{\sqrt{\frac{889}{891}}}+1x^{\sqrt{\frac{943}{945}}}+1x^{\sqrt{\frac{412}{413}}}+1x^{\sqrt{\frac{733}{735}}}+1x^{\sqrt{\frac{943}{945}}}+1x^{\sqrt{\frac{803}{805}}}\\&+1x^{\sqrt{\frac{843}{845}}}+3x^{\sqrt{\frac{943}{945}}}+x^{\sqrt{\frac{1051}{1053}}}.\end{aligned}$$

Proof: Applying definition and edge partition of hydroxychloroquine, we conclude

$$\begin{aligned}DABS(H,x)=&\sum_{uv\in E(H)}x^{\sqrt{\frac{d_d(u)+d_d(v)-2}{d_d(u)+d_d(v)}}}\\=&1x^{\sqrt{\frac{210+350-2}{210+350}}}+1x^{\sqrt{\frac{210+425-2}{210+425}}}+1x^{\sqrt{\frac{207+324-2}{207+324}}}+1x^{\sqrt{\frac{207+567-2}{207+567}}}+1x^{\sqrt{\frac{315+317-2}{315+317}}}+1x^{\sqrt{\frac{315+385-2}{315+385}}}\\&+2x^{\sqrt{\frac{315+420-2}{315+420}}}+1x^{\sqrt{\frac{315+425-2}{315+425}}}+1x^{\sqrt{\frac{317+340-2}{317+340}}}+1x^{\sqrt{\frac{317+385-2}{317+385}}}+1x^{\sqrt{\frac{324+324-2}{324+324}}}+1x^{\sqrt{\frac{324+459-2}{324+459}}}\\&+1x^{\sqrt{\frac{324+567-2}{324+567}}}+1x^{\sqrt{\frac{324+621-2}{324+621}}}+1x^{\sqrt{\frac{340+486-2}{340+486}}}+1x^{\sqrt{\frac{350+385-2}{350+385}}}+1x^{\sqrt{\frac{350+595-2}{350+595}}}+1x^{\sqrt{\frac{385+420-2}{385+420}}}\\&+1x^{\sqrt{\frac{420+425-2}{420+425}}}+3x^{\sqrt{\frac{459+486-2}{459+486}}}+1x^{\sqrt{\frac{486+567-2}{486+567}}}.\end{aligned}$$

By solving the above equation, we get the desired result.

We compute the multiplicative domination atom bond sum connectivity index of hydroxychloroquine.

Theorem 6. The multiplicative domination atom bond sum connectivity index of hydroxychloroquine is given by

$$DABSII(H)=0.9687107182$$

Proof: Applying definition and edge partition of hydroxychloroquine, we conclude

$$\begin{aligned}DABSII(H)=&\prod_{uv\in E(H)}\sqrt{\frac{d_d(u)+d_d(v)-2}{d_d(u)+d_d(v)}}\\=&\left(\sqrt{\frac{210+350-2}{210+350}}\right)^1\times\left(\sqrt{\frac{210+425-2}{210+425}}\right)^1\times\left(\sqrt{\frac{207+324-2}{207+324}}\right)^1\times\left(\sqrt{\frac{207+567-2}{207+567}}\right)^1\\&\times\left(\sqrt{\frac{315+317-2}{315+317}}\right)^1\times\left(\sqrt{\frac{315+385-2}{315+385}}\right)^1\times\left(\sqrt{\frac{315+420-2}{315+420}}\right)^2\times\left(\sqrt{\frac{315+425-2}{315+425}}\right)^1\\&\times\left(\sqrt{\frac{317+340-2}{317+340}}\right)^1\times\left(\sqrt{\frac{317+385-2}{317+385}}\right)^1\times\left(\sqrt{\frac{324+324-2}{324+324}}\right)^1\times\left(\sqrt{\frac{324+459-2}{324+459}}\right)^1\end{aligned}$$

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

$$\times\left(\sqrt{\frac{324+567-2}{324+567}}\right)^{1}\times\left(\sqrt{\frac{324+621-2}{324+621}}\right)^{1}\times\left(\sqrt{\frac{340+486-2}{340+486}}\right)^{1}\times\left(\sqrt{\frac{350+385-2}{350+385}}\right)^{1}$$

$$\times\left(\sqrt{\frac{350+595-2}{350+595}}\right)^{1}\times\left(\sqrt{\frac{385+420-2}{385+420}}\right)^{1}\times\left(\sqrt{\frac{420+425-2}{420+425}}\right)^{1}\times\left(\sqrt{\frac{459+486-2}{459+486}}\right)^{3}$$

$$\times\left(\sqrt{\frac{486+567-2}{486+567}}\right)^{1}.$$

By solving the above equation, we get the desired result.

4. CONCLUSION

In this paper, we have computed the domination atom bond sum connectivity index and multiplicative domination atom bond sum connectivity index of two chemical drugs such as chloroquine and hydroxychloroquine.

REFERENCES

1. V.R.Kulli, *College Graph Theory*, Vishwa International Publications, Gulbarga, India (2012).
2. V.R.Kulli, *Theory of Domination in Graphs*, Vishwa International Publications, Gulbarga, India (2010).
3. S.Wagner and H.Wang, *Introduction Chemical Graph Theory*, Boca Raton, CRC Press, (2018).
4. M.V.Diudea (ed.) *QSPR/QSAR Studies by Molecular Descriptors*, NOVA New York, (2001).
5. S.Raju, Puttuswamy and A.Alsinai, Different type's domination topological indices of some chemical drugs graph, *Eur. Chem. Bull.* 12(5) (2023) 4334-4345.
6. A.M.Hanan Ahmed, A.Alwardi and M.Ruby Salestina, On domination topological indices of graphs, *International Journal of Analysis and Applications*, 19(1) (2021) 47-64.
7. V.R.Kulli, Domination Nirmala indices of graphs, *International Journal of Mathematics and Computer Research*, 11(6) (2023) 3497-3502.
8. V.R.Kulli, Multiplicative domination Nirmala indices of graphs, *International Journal of Mathematics And its Applications*, 11(3) (2023) 11-20.
9. V.R.Kulli, Domination Dharwad indices of graphs, submitted.
10. V.R.Kulli, Domination product connectivity indices of graphs, *Annals of Pure and Applied Mathematics*, 27(2) (2023) 73-78.
11. V.R.Kulli, Domination augmented Banhatti, domination augmented Banhatti sum indices of certain chemical drugs, *International Journal of Mathematics and Computer Research*, 11(7) (2023) 3558-3564.
12. V.R.Kulli, Irregularity domination Nirmala and domination Sombor indices of certain drugs, *International Journal of Mathematical Archive*, submitted.
13. V.R.Kulli, Atom bond connectivity E-Banhatti indices, *International Journal of Mathematics and Computer Research*, 11(1) (2023) 3201-3208.
14. V.R.Kulli, Different versions of atom bond connectivity index, *International Journal of Engineering Sciences and Research Technology*, 12(3) (2023) 1-10.
15. V.R.Kulli, Neighborhood sum atom bond connectivity indices of some nanostar dendrimers, *International Journal of Mathematics and Computer Research*, 11(2) (2023) 3230-3235.
16. B.Basavanagoud, V.R.Kulli and V.V.Teli, Equitable dominating graph, *International Journal of Mathematical Sciences and Engineering Applications*, 9(2) (2015) 109-114.
17. V.R.Kulli, The semientire total dominating graph. *Advances in Domination Theory-II*, (2013) 75-80.
18. V.R.Kulli and B.Janakiram, The block nonsplit domination number of a graph, *International Journal of Management of Systems*, 20(2004) 219-228.
19. V.R.Kulli and R.R.Iyer, The total minimal dominating graph, *Advances in Domination Theory-I*, (2012) 121-126.
20. V.R.Kulli and B.Janakiram, Regular set domination in graphs, *National Academy Science Letters (India)*, 32(11) (2009) 351.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

21. V.R.Kulli, Inverse and disjoint secure dominating sets in graphs, *International Journal of Mathematical Archive,* 7(8) (2016) 13-17.
22. V.R.Kulli, The disjoint total domination number of a graph, *Annals of Pure and Applied Mathematics,* 11(2) (2016) 33-38.
23. V.R.Kulli, On entire domination transformation graphs and fuzzy transformation graphs, *International Journal of Fuzzy Mathematical Archive,* 8(1) (2015) 43-49.
24. V.R.Kulli and N.D.Soner, The connected total domination number of a graph, *Journal of Analysis and Computation*, 2(2) (2006) 183-189.
25. V.R.Kulli, Inverse and disjoint restrained domination in graphs, *International Journal of Fuzzy Mathematical Archive,* 11(1) (2016) 9-15.
26. H.Ahmed, A.Alwardi, M.Ruby Salestina and N.D.Soner, Domination, γ-domination topological indices and φ-polynomial of some chemical structures applied for the treatment of COVID-19 patients, *Biointerface Research in Applied Chemistry,* 11(5) (2021) 13290-13302.