Punjab University Journal of Mathematics (2022),54(9),575-592
https://doi.org/10.52280/pujm.2022.540902

Chromatic Index and Line graphs of Neighbourly Irregular Fuzzy Chemical Graphs(G_{NIFC}) among s-block and p-block elements

S. Anjalmose[1] and J. Arockia Aruldoss[2]
PG and Research Department of Mathematics
St. Joseph's College of Arts and Science (Autonomous)
Cuddalore, Tamil Nadu, INDIA.
Email: [1] ansalmose@gmail.com   Email: [2] aruligori@gmail.com

Received: 02 December, 2021 / Accepted: 20 September, 2022 / Published online: 29 September, 2022

Abstract.: In this paper, we have worked on fuzzy vertex coloring and fuzzy edge coloring for neighbourly irregular chemical graph G_{NIC} and its complement graph $\tilde{G}_{NIC}$. Also derived line graphs $L(G_{NIC})$ of neighbourly irregular chemical graph and line graph of complement neighbourly irregular chemical graph $(L(\tilde{G}_{NIC}))$. Using fuzzy edge coloring, we have find chromatic index for $\xi(G_{NIFC})$, irregular chromatic index $\xi_{ir}(G_{NIFC})$ also for $\xi_{ir}L(G_{NIFC})$ and $\xi_{ir}L(\tilde{G}_{NIFC})$. We have given the required propositions with the required examples for each. And we fund strength of the $\xi L(G_{NIFC}) = (N, W)$, and the colors.

AMS (MOS) Subject Classification Codes: 35S29; 40S70; 25U09
Key Words: Fuzzy chemical graphs, Neighborly irregular fuzzy chemical graphs, Fuzzy coloring, Chromatic index and Strength of the neighborly irregular fuzzy chemical graphs.

1. Introduction

In a graph $G = (V, X)$, where V represents the vertex set and X represents the edge set. Then the chemical graph is $G_C = (A, B)$ where A represents atoms and B represents bond set, in the molecular structure of molecules named as chemical graph. Among the molecules in the periodic table the molecular structure of S block and p block elements forms neighbourly irregular chemical graphs(G_{NIC}). Nenad Trinajstic [6] introduced the concept of chemical graph theory, S.K Ayyasamy et al [5] introduced the concept of neighbourly irregular graphs. J. Arokia Aruldoss et all [4] introduced Negibourly irregular chemical graph and irregular chromatic number for line graph of the same S.Anajalmose et all [1] introduced the idea of Neighbourly irregular fuzzy chemical graphs. Arindam Dey [2] et all introduced the concept of edge coloring of complement fuzzy graph. In this paper, we discuss the chromatic index and the strength of $G_{NIFC}, \tilde{G}_{NIFC}$ and their line graphs $L(G_{NIFC})$ and its complement graph $L(\tilde{G}_{NIFC})$.

2. PRELIMINARIES

Definition 2.1. [3] *The molecular structure of a chemical graph corresponding elements of atoms having different valency in its adjacent atoms is said to be a neighborly irregular chemical graphs* (G_{NIC})*. Such that* $G_{NIC} = (A, B)$*, where* A*-atoms,* B*-bonds*

Example 2.2.

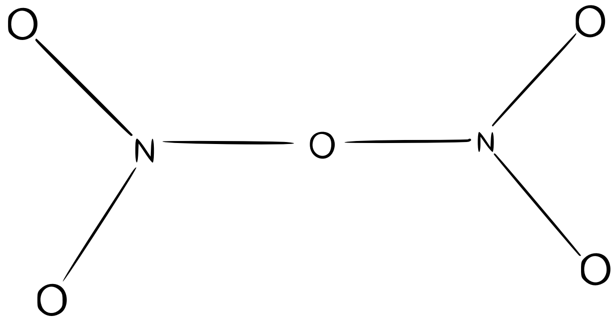

FIGURE 1. Dinitrogen Pentaxide (N_2O_5)

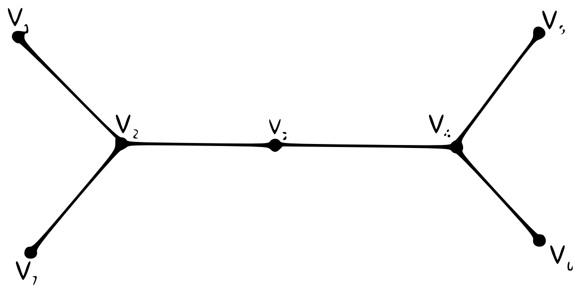

FIGURE 2. G_{NIC} of Dinitrogen Pentaxide

Definition 2.3. [1] *Let* $G = (V, \sigma, \mu)$ *be a connected fuzzy chemical graph. Then* G *is said to be Neighborly irregular fuzzy chemical graph if any two adjacent vertices of* G *have distinct degrees with corresponding membership values* (G_{NIFC})*.*

Example 2.4.

From the below figure $d(u_1) = 0.6,\quad d(u_2) = 0.4,\quad d(u_3) = 1.1,\quad d(u_4) = 1.0,\quad d(u_5) = 1.2,\quad d(u_6) = 0,\quad d(u_7) = 0.3$

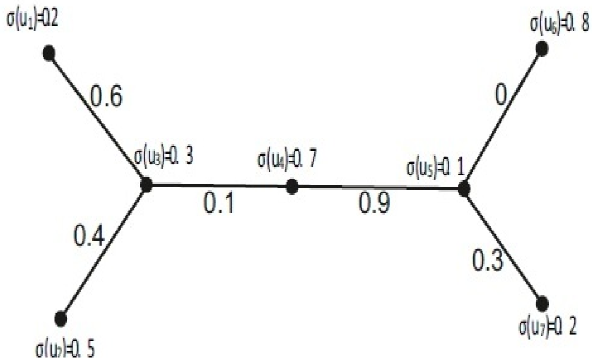

FIGURE 3. G_{NIFC} of N_2O_5

Note: Color codes are assigned using number of colors and number of times used in the path between two vertices

Definition 2.5. [4] *Let G be a neighborly irregular chemical graph, V the vertex set of G and let $\{1, 2, \ldots, k\}$ be the colors assigned to each vertex. A coloring is proper in a NIC graph is the function $C : V \to \{1, 2, \ldots, k\}$ such that $c(x) \neq c(y)$, for any two adjacent vertices $x, y \in V$.*

Definition 2.6. [4] *An irregular coloring of a graph is no two like colored vertices have the same color code. Such that every pair of vertices v and w, color codes of v not equal to color codes of w $[c(v) \neq c(w)]$. Whenever $c(v) = c(w)$. Thus, an irregular coloring varies each vertex from each other vertex either by its color or color codes.*

Definition 2.7. [4] *The irregular chromatic number $\chi_{ir}(G_{NIC})$ is the smallest positive integer k for which G_{NIC} has an irregular k-coloring. Denoted by $\chi_{ir}(G_{NIC}) = k$.*

Note:$\chi_{ir}(G_{NIC}) \geq \chi(G_{NIC})$.

Example 2.8.

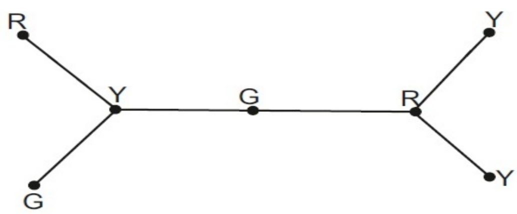

FIGURE 4. $\chi_{ir}(G_{NIC}) = 3$

Definition 2.9. [4] *A neighborly irregular coloring of G_{NIC} is every two adjacent vertices having distinct colors $\chi_{NI}(G_{NIC}) = k$.*

Note: For any graph G, G_{NI} or G_{NIC} coloring defines the same,

Example 2.10.

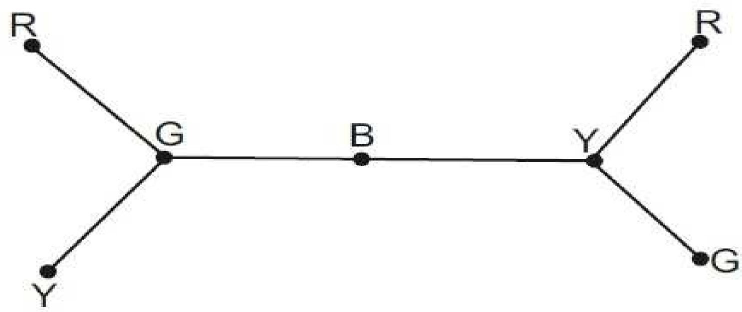

FIGURE 5. $\chi_{NI}(G_{NIC}) = 4$

3. FUZZY COLORING

Combination of two distinct colors gives an another color, but mixing white color with different colors reduce the solitity (stability) of the color. Here solubility is a fuzzy term. i.e., w units of a color C_r is mixed with $1 - w$ of white color, where $w < 1$. The resultant is called a fuzzy color C_k and C_r is called the basic color.

Definition 3.1. *In a fuzzy coloring, basic colors are the minimum number of color used to respective graph G. Here $C = \{c_1, c_2, \cdots, c_k\}$*

Definition 3.2. [7] *Let $C = \{c_1, c_2, \ldots, c_n\}$, $n \geq 1$ be the set of basic colors. Then (c, f) is called the set of fuzzy colors, here $f : C \to [0, 1]$ with $f(c_i)$, where $f(c_i) = 1 - w$, w is the unit of color c_i. The color $\tilde{c}_i = (c_i, f(c_i))$ is called the fuzzy color, corresponding to the basic color c_i. The membership value is taken as 1.*

While coloring neighborly irregular fuzzy chemical graph (G_{NIFC}), the fuzzy color depends upon its adjacent vertices with strong edges and weak edges.

Definition 3.3. *let $\xi = (V, \sigma, \gamma)$ be a connected fuzzy graph and $C = \{c_1, c_2, \cdots, c_k\}$ set of basic colors. The two edges are given two different basic colors, if they are adjacent. Otherwise their fuzzy colors may be given with same basic colors. The membership value for each edge is assigned as $f_{e_j}(c_i) = \frac{\gamma(v,w)}{\sigma(v)\wedge\sigma(w)}$, $fe_j(C_i)$ is the membership value*

where $\sigma(v)$ and $\sigma(w)$ are the membership values of vertices v and w respectively, $\sigma(v) \wedge \sigma(w)$ is minimum value of $\sigma(v)$ and $\sigma(w)$. Also $\gamma(v, w)$ is the membership value of the edge e_j.

Example 3.4.

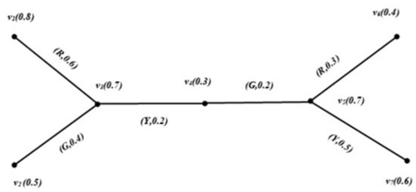

FIGURE 6. Basic Colors are $\{G = 0.0,\ R = 0.6,\ Y = 0.9\}$

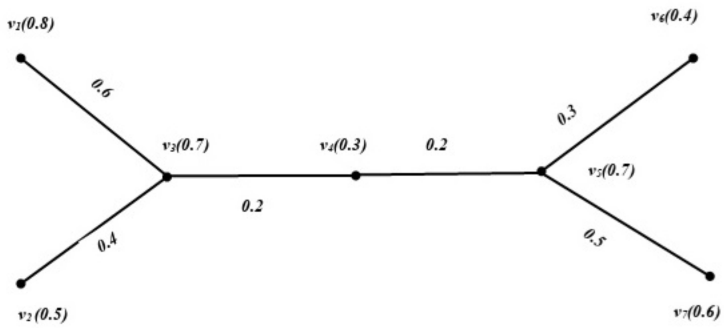

FIGURE 7. G_{NIFC} of Dinitrogen Pentaxide (N_2O_5)

4. CHROMATIC INDEX OF NEIGHBORLY IRREGULAR FUZZY CHEMICAL GRAPHS

Definition 4.1. *The chromatic index of the given neighbourly irregular fuzzy chemical graph is $G_{NIFC} = (N, W)$. Where N the number of base colors used to color a graph and $W = \sum_{j=1}^{N} \{\max_i f_{e_i}(c_j)\}$, where the base color c_j is used to color the edge e_i.*

Note: The weight of the chromatic index of neighbourly irregular fuzzy chemical graph is depending upon the decision makers of a particular graph. Here the decision makers mean the membership value assigned by the concern.

Definition 4.2. *Let $G_{NIC} = (V, X)$ be a graph. Then $\tilde{G}_{NIC}$ is the complement graph which has the set V as its points and two points are adjacent in $\tilde{G}_{NIC}$ if and only if they are not in G_{NIC}.*

Example 4.3.

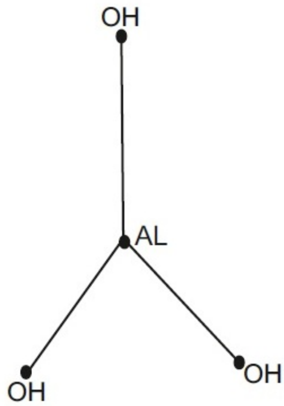

FIGURE 8. Aluminum Hydroxide $(Al(OH)_3)$

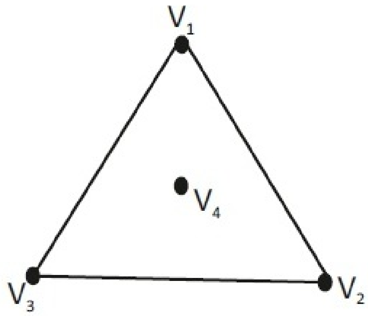

FIGURE 9. Complement of Aluminum Hydroxide $(Al(OH)_3)$

Definition 4.4. *Let $G_{NIFC} = (V, \sigma, \gamma)$ be a neighborly irregular fuzzy chemical graph. The complement graph $\tilde{G}_{NIFC}$ is the graph which has the set V as its vertices and two vertices are adjacent in $\tilde{G}_{NIFC}$ if and only if they are not adjacent in G_{NIFC}. It is denoted by $\tilde{G}_{NIFC} = (V, \sigma, \gamma)$ with same $\sigma(u_i)$ and $\gamma(x, y)$ depends.*

Definition 4.5. *$L(G_{NIC})$ is the line graph of any neighborly irregular chemical graph (G_{NIC}) is such that every vertex of $L(G_{NIC})$ represents an edge of G_{NIC}. Two vertices of $L(G_{NIC})$ are adjacent if and only if their corresponding edges are incident in G_{NIC}.*

Example 4.6.

Definition 4.7. *A neighborly irregular chemical graph (G_{NIC}) is called a bi graph if V can be partitioned into two distinct subsets V_1 and V_2 such that every edge of G_{NIC} joints a vertex of V_1 to a vertex of V_2, (V_1, V_2) is called a bi-partition of G_{NIC}. Also if G_{NIC} contains every edge joining the vertices of V_1 to the vertices of V_2, then G_{NIC} is called a*

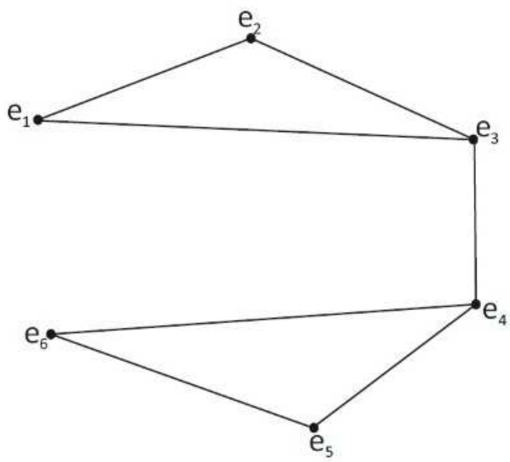

FIGURE 10. $L(G_{NIC})$ of (N_2O_5)

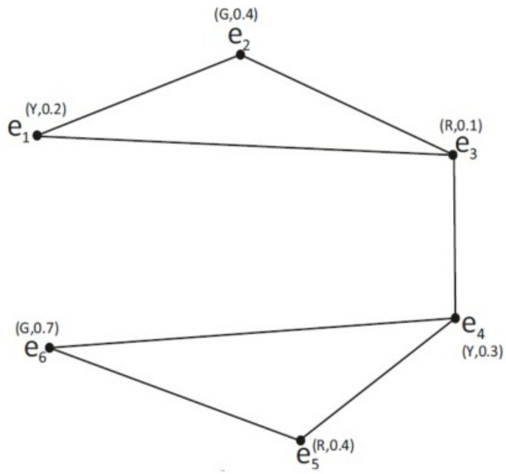

FIGURE 11. Fuzzy Coloring of $L(G_{NIC})$ of (N_2O_5)

neighborly irregular complete bipartite chemical graph $K_{NIC}(m,n)$. Here $|V_1| = m$ and $|V_2| = n$.

Example 4.8.

Here $V_1 = \{v_1\}$. $V_2 = \{v_2, v_3, v_4\}$, where $m \geq 1$.

Note: Any neighborly irregular chemical graph is not complete, but a bi-partite neighborly irregular chemical graph G_{BNIC} is always complete with $K_{1,m}$, where $m \geq 1$.

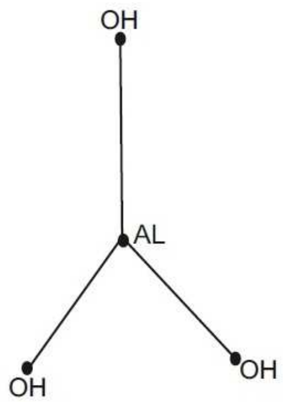

FIGURE 12. G_{NIC} of $(Al(OH)_3)$

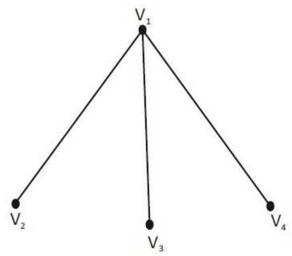

FIGURE 13. Bi-partite of G_{NIC} of $(Al(OH)_3)$

Proposition 4.9. *For some line graph $[L(G_{NIC})]$, The irregular chromatic number $\xi_{ir}(L(G_{NIC}))$ is either 3 or 4 for $n \geq 4$. And the chromatic index for the corresponding Neighborly Irregular Fuzzy Chemical Graph $L(G_{NIFC})$ is*
$\xi L(G_{NIFC}) = (N, W)$, where $N = 3$ or 4 and $W \leq 3$ or < 4.

Proof: Let $\{v_1, v_2, \ldots, v_m\}$ be the number of atoms in the molecular structure of order 'm'.

And $\{e_1, e_2, \ldots, e_n\}$ be the edges of G_{NIC}

Since the given graph is Neighborly Irregular, the degree of any two adjacent vertices are distinct.

i.e., $d(v_i) \neq d(v_{i+1})$ or $d(v_{i-1})$; $i = 1, 2, \ldots, m$. The number of colors used for edges of any two adjacent vertices are not equal.

Since G_{NIC} is not complete graph,

$\xi(G_{NIC}) < 0(G_{NIC})$

$\xi(G_{NIC}) < 0(G_{NIC})$

i.e., $\xi(G_{NIC}) < m \longrightarrow (1)$

Now considering its line graph $L(G_{NIC})$ will surely have cycles.

And any G_{NIC} will not have isolated vertices.

Any cycle can be colored with almost 3 or 4 colors if it is not complete.
So, the entire cycles of the graph can be colored with either 3 or 4 colors.
i.e., $\xi((G_{NIC})$ =3 or 4
for any Neighborly Irregular Chemical Graph (G_{NIC}),
$\xi(G_{NIC}) = \xi_{ir}(G_{NIC})$
thus $\chi_{ir}(G_{NIC})$ =3 (or) 4.
Now to the other part of the proof,
simultaneously, we find the membership values of vertices using fuzzy coloring and for edges using fuzzy edge coloring.
i.e., $\tilde{c}_i = (c_i, f(c_i))$; where $f(c_i) = 1 - w$, w is the unit of color c_i, $w \leq 1$
and c_i is the basic color, $\tilde{c}_i$ is the fuzzy color corresponding to the basic color c_i.
And the edge color
$\tilde{c}_i = (c_i, f_{e_j}(c_i))$; c_i is the basic color,
$e_j = (v, w)$ and
$f_{e_j}(c_i) = \frac{\gamma(v,w)}{\sigma(v) \wedge \sigma(w)}$.
claim: Chromatic index of $L(G_{NIC})$ is,
$\xi L(G_{NIFC}) = (N, W)$
where, $N = \chi_{ir} L(G_{NIC})$ and
$W = \sum_{i=1}^{N} \{\max_j f_{e_j}(c_i)$.
Since for the line graph of any Neighborly irregular Fuzzy Chemical Graph,
the chromatic index is either 3 or 4.
We at most have 3 or 4 basic colors and for each basic color we get the membership value $n \leq 1$. And the summation is taken, which results,
$\xi L(G_{NIFC}) = (N, W)$, where $N = 3$ or 4 and $W \leq 3$ or < 4.

Example 4.10.

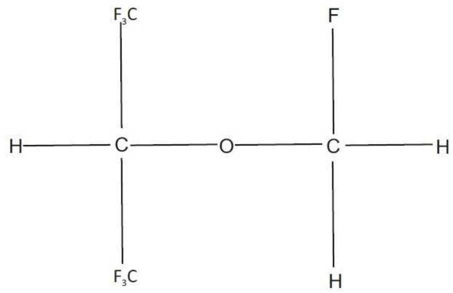

FIGURE 14. Restricted Molecular Structure of Sero Flurane $(C_4H_3F_7O)$

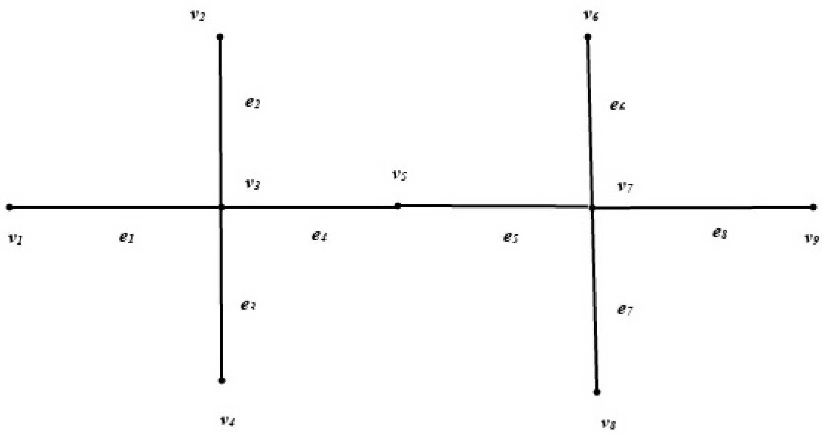

FIGURE 15. G_{NIC} of $(C_4H_3F_7O)$

We now find the chromatic index from the below fuzzy graph.

$$\begin{aligned} W &= \sum_{i=1}^{N} \max_j f_{e_j}(c_i) \\ &= 0.82 + 0.97 + 0.77 + 0.83 \\ &= 3.39 \end{aligned}$$

where the membership values respectively of Blue, Red, Orange, Green is

$$\begin{aligned} B &= 0.8, 0.63, 0.38, 0.82 \\ R &= 0.75, 0.97, 0.75, 0.38 \\ O &= 0.77, 0.71, 0.72, 0.67 \\ G &= 0.83 \end{aligned}$$

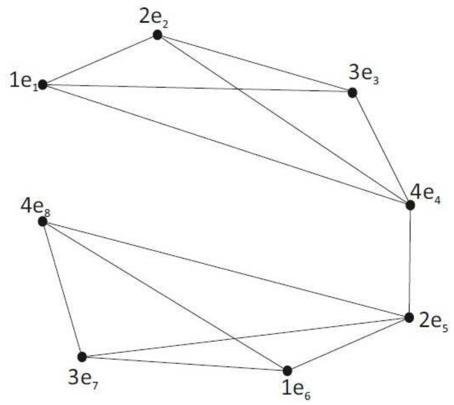

FIGURE 16. Coloring of $L(G_{NIC})$

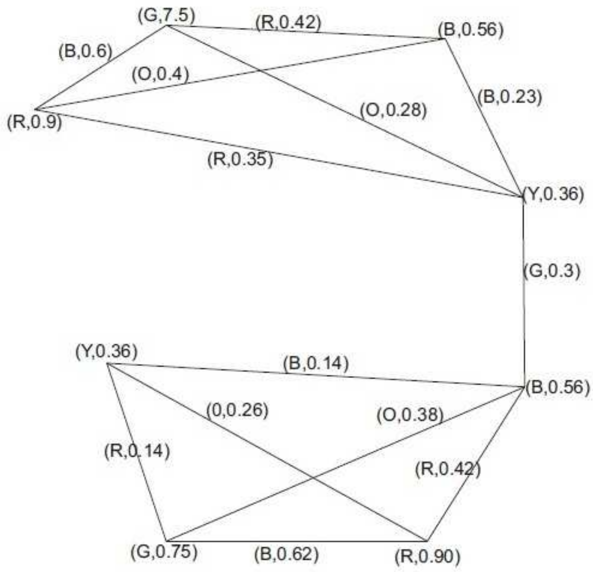

FIGURE 17. Fuzzy Coloring of $L(G_{NIC})$

Thus the chromatic index of this G_{NIFC} is
$(N, W) = (4, 3.39)$ in which $W < 4$ when $N = 4$.

Proposition 4.11. *The chromatic index of* $L[G_{NIFC}]$ *is* $\xi L(G_{NIC}) = (N, N)$ *if* $L[G_{NIFC}]$ *is complete.*

Proof: Let us consider a G_{NIC} graph such that $L[G_{NIC}]$ is complete. Now, we construct a Neighborly Irregular Fuzzy Chemical Graph, by assigning fuzzy coloring and fuzzy edge coloring to $L[G_{NIC}]$. The resultant graph is $L(G_{NIC})$.

Let $G_{CNIFC} = (V, \sigma, \gamma)$ be a complete fuzzy graph where $\gamma(v, w) = \sigma(v) \wedge \sigma(w)$ and $\frac{\gamma(v,w)}{\sigma(v)\wedge\sigma(w)} = 1$, the membership value of each basic color is 1. since $L(G_{NIC})$ is complete with n atoms $W = N$. Thus, we get Chromatic index $\xi L(G_{NIFC}) = (N, N)$.

5. Chromatic Index Fuzzy Line Graph of Complete Bi-partite Neighborly Irregular Chemical Graph (G_{CBNIC})

Proposition 5.1. *Let $L_F(G_{NIC})$ be a fuzzy line graph of complete bi-partite Neighborly Irregular chemical graph (G_{CBNIC}) of order n, then $\xi(L(K_{1,m})) < m$, for every $m \geq 3$.*

Proof: Let $\{v_1, v_2, \ldots, v_n\}$ be the atoms of complete bi-partite NIC graph as $K_{1,m}$, with the edge set $\{e_1, e_2, \ldots, e_m\}$. This covalent bonds are considered as vertices of line graph of complete bi-partite $K_{1,m}$.

If $m = 3$, then $\chi_{ir}(L(K_{1,3})) = 3$.
If $m = 4$, then $\chi_{ir}(L(K_{1,4})) = 4$.
If $m = 5$, then $\chi_{ir}(L(K_{1,5})) = 5$.

Since complete bi-partite G_{NIC} is $K_{1,m}$, there is no way to obtain cycle in the graph and those m vertices are of degree 1.

The number of colors needed to color the graph $L(K_{1,m}) = m = \chi_{ir}(L(K_{1,m}))$
therefore, $\chi_{ir}(L(K_{1,m})) = m$.
Further, we find fuzzy coloring and fuzzy edge coloring.
Now, $L(K_{1,m})$ becomes $L_F(K_{1,m})$, since the membership value lies between [0,1].
$\xi(L(K_{1,m})) < m$, for every $m \geq 3$.
This completes the proof.

Example 5.1. Consider the line graph $L(G_{NIC})$ of complete bi-partite graph $K_{1,3}$ of Aluminum Hydroxide $[Al(OH)_3]$

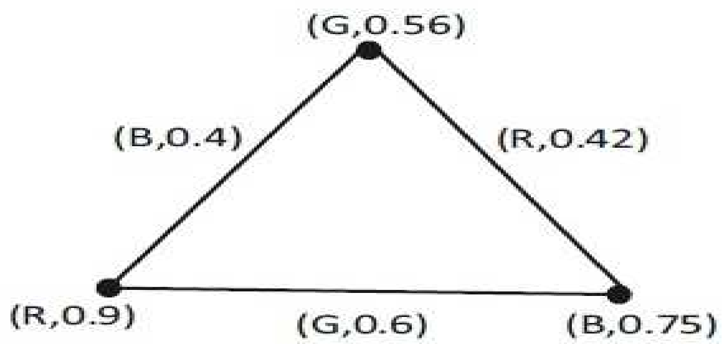

FIGURE 18. $L(K_{1,3}) = 3$ for $(Al(OH)_3)$

For above proposition, we can also consider the molecular structure of $P(Br)_5$ and $C(Cl)_4$.

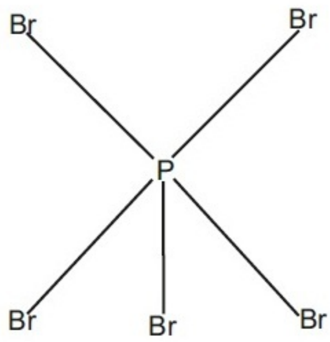

FIGURE 19. Phosphorous Pentabromite $(P(Br_5))K_{1,5}$

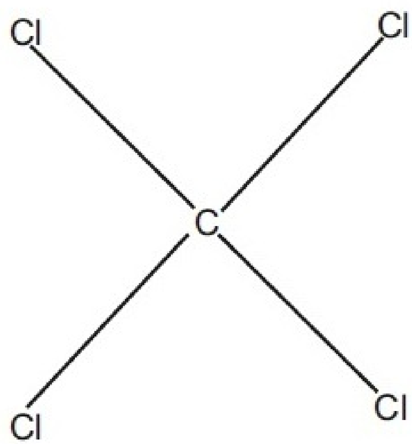

FIGURE 20. Carbon tetra Chloride $(C(Cl)_4)K_{1,4}$

Remark 5.2. *1. Line graph of every $K_{1,m}$ is always a complete graph.*
2. Chromatic index of a fuzzy graph or fuzzy chemical graph is always less then the chromatic number of the same graph.

Proposition 5.3. *For any neighborly irregular chemical graph G_{NIC}, both $L(G_{NIC})$ and $L(\tilde{G}_{NIC})$ $\xi_{ir}L[G_{NIC}] = \xi_{ir}L[\tilde{G}_{NIC}]$ and also for the line graph of G_{NIFC} and $\tilde{G}_{NIFC}$ the chromatic index is $\xi L[G_{NIFC}] < \xi L(\tilde{G}_{NIFC})$.*

Proof: Let G_{NIC} be a Neighborly Irregular Chemical Graph and the Irregular Chromatic number of G_{NIC} be $\xi_{ir}(G_{NIC}) = r$. Now, the Irregular Chromatic number for $L(G_{NIC})$ is $\xi_{ir}(G_{NIC}) = m$.

Let $\tilde{G}_{NIC}$ be the complement graph of G_{NIC} such that Irregular Chormatic number for $L(\tilde{G}_{NIFC}) = n$. $\xi_{ir}L(\tilde{G}_{NIFC}) = n$.

Claim: $m = n$, (if m, n are positive integers) **To Prove:** (i) $m \leq n$
(ii) $m \geq n$.

(i) Since $\xi_{ir} L[G_{NIC}] = m$, the number of vertices of $L[G_{NIC}] \leq$the number of vertices of $L(\tilde{G}_{NIC})$

the number of Colors needed for $L[G_{NIC}] \leq$the number of Colors of $L(\tilde{G}_{NIC})$

$\xi_{ir} L[G_{NIC}] \leq \xi_{ir} L(\tilde{G}_{NIC})$

$m \leq n \longrightarrow (1)$

(ii) $deg[\sum_i \tilde{G}_{NIC}] \geq deg[\sum_j G_{NIC}]$

However as number of vertices increases in $L(\tilde{G}_{NIC})$, so the number of edges.

Thus, the number of Colors needed for $L(\tilde{G}_{NIC}) \leq$ number of Colors needed for $L[G_{NIC}]$

i.e., $\xi_{ir} L(\tilde{G}_{NIC}) \leq \xi_{ir} L[G_{NIC}]$.

$n \leq m \longrightarrow (2)$

From (1) & (2), we get $m = n$.

For the second part of the proof, we need to give the membership values for the vertices and edges using fuzzy coloring and fuzzy edge coloring respectively.

From (1), it is clear that $\circ(\tilde{G}_{NIFC}) \geq \circ(G_{NIFC})$

$\circ[L(\tilde{G}_{NIFC}) \geq \circ[L(G_{NIC})]$

Since for a G_{NIFC},

both $L[G_{NIFC}]$ & $L(\tilde{G}_{NIFC})$ will not get an isolated vertex.

Number of edges of $L(\tilde{G}_{NIFC}) \geq$ Number of edges of $L[G_{NIFC}]$

$\therefore \;\; \xi L[G_{NIFC}] \leq \xi L(\tilde{G}_{NIFC})$.

The proof is completed.

Note: For a G_{NIC}, there is no isolated vertex in its $L[G_{NIC}]$ and $L(\tilde{G}_{NIC})$.

Example 5.4. *We consider the G_{NIC} of Arsenic Trioxide* (As_4O_6)

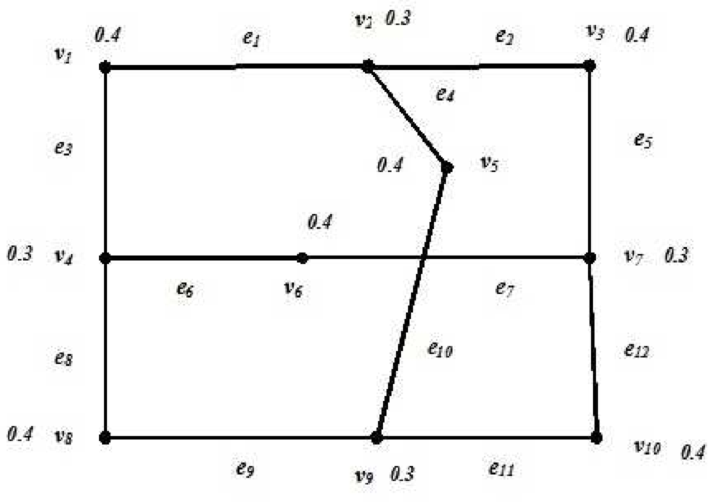

FIGURE 21. G_{NIC} of (As_4O_6)

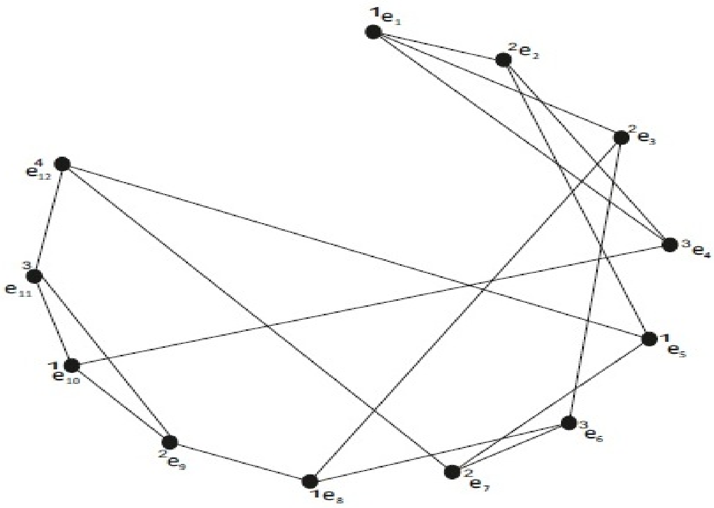

FIGURE 22. $L[G_{NIC}]$ of (As_4O_6)

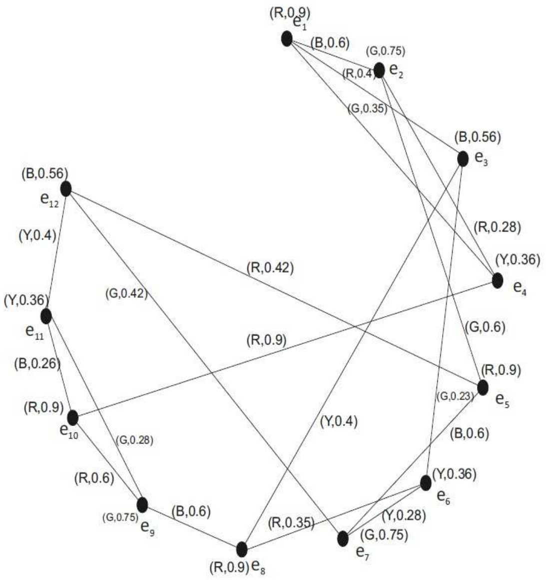

FIGURE 23. $L[G_{NIFC}]$ of (As_4O_6)

Here $C : E \to \{1, 2, 3, 4\}$ and $\chi_{ir} L[G_{NIC}] = 4$.
Now to find the Chromatic index of $L[G_{NIFC}]$,

$$\begin{aligned} W &= \sum_{i=1}^{N} \max_j f_{e_j}(c_i) \\ &= 0.6 + 0.6 + 0.6 + 0.4 \\ &= 2.2 \end{aligned}$$

Thus the chromatic index of (As_4O_6) is
$\therefore\ \xi L[G_{NIFC}] = (N, W) = (4, 2.2)$. Clearly $W < 4$.
Similarly, we can also find the chromatic index $\xi L(\tilde{G}_{NIFC})$ of (As_4O_6). $\therefore\ \xi L[G_{NIFC}] < \xi L(\tilde{G}_{NIFC})$.

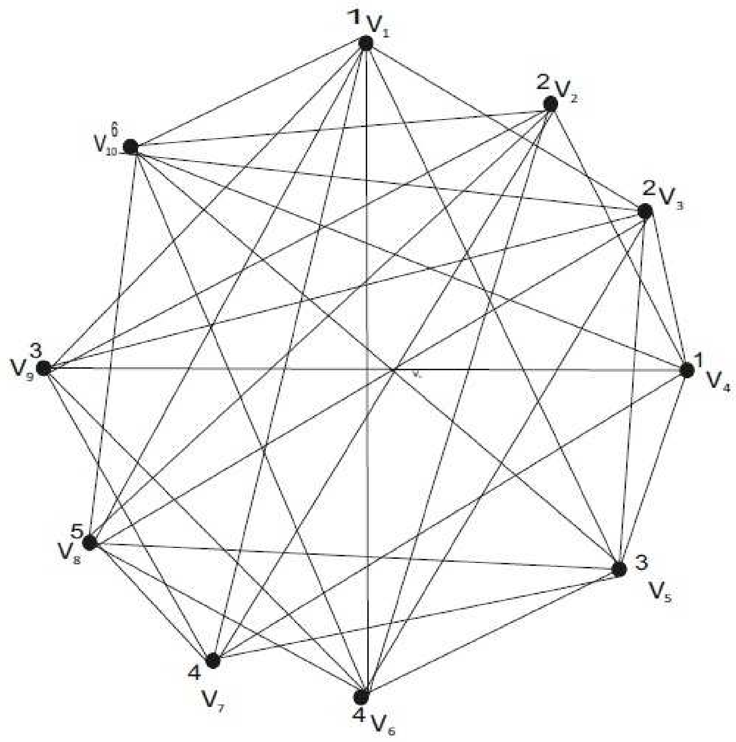

FIGURE 24. $L[\tilde{G}_{NIC}]$ of AS_4O_6

Observation: The color codes for $L[G_{NIC}]$ of (As_4O_6).

Edges	Color Codes
$C(e_1)$	10210
$C(e_2)$	22010
$C(e_3)$	22010
$C(e_4)$	32100
$C(e_5)$	10201
$C(e_6)$	31200
$C(e_7)$	21011
$C(e_8)$	10210
$C(e_9)$	22010
$C(e_{10})$	10120
$C(e_{11})$	31101
$C(e_{12})$	41110

Number of atoms of G_{NIC}	$\chi_{ir}(G_{NIC})$	$\xi L[G_{NIFC}]$	Molecules Name
4	3	< 3	Arsenic chloride $(AsCl_3)$
5	3	< 3	Bentaborane (B_5H_9)
6	4	< 4	Di sulfur Tetrafluride (F_4S_2)
7	3	< 3	Dinitrogen pentaxide (N_2O_5)
8	4	< 4	Diborane (B_2H_6)
9	4	< 4	Seroflurane $(C_4H_3F_7O)$
10	4	< 4	Arsenic Trioxide (As_4O_6)
11	3	< 3	Berillium borohydride $(Be(BH_4)_2)$

6. Conclusion

In this paper, we find the chromatic index for the neighborly irregular fuzzy chemical graphs $\xi(G_{NIFC})$ and also for its line graphs $\xi L(G_{NIFC})$ by using fuzzy coloring and fuzzy edge coloring. Then we find the strength of those graphs. Further we can find the chromatic index for the complete bi-partite Neighborly irregular fuzzy chemical graphs.

References

[1] S. Anjalmose and J. Arockia Aruldoss *Neighborly irregular fuzzy chemical graphs*, Stochastic modeling & Applications, **26,** No. 3 (2022) 161-173.

[2] Arindam Dey, Anita Pal and Dhrubajyoti Ghosh, *Edge coloring of a Complement Fuzzy Graph*, International Journal of Modern Engineering Research (IJMER), **2,** No.4 (2012) 1929-1933.

[3] J. Arockia Aruldoss and S. Gnanasoundari, *Construction of neighbourly irregular chemical graphs among s-block and p-block elements combinations and its size*, International Journal of Current Advanced Research, **7** (2018) 91-94.

[4] J. Arockia Aruldoss and U. Gogulalakshmi, *Irregular Chromatic number of Line graph of Neighbourly irregular Chemical graph among s-block and p-block elements*, JETIR **6** No.4 (2019) 667-676.

[5] S. K. Ayyaswamy and S. Gnaana Bhragasam, *Neighbourly Irregular Graphs*, Indian J. Pure Appl. Math., **35,** No. 3 (2004) 389-399.

[6] S. Samanta, M. Pal and T. Pramanik, *Fuzzy coloring of fuzzy graphs*, Afrika Matematika. February 2015. **DOI: 10.1007/s13370-015-0317-8.**

[7] N. Trinajstic, *Chemical graph theory*, crc press-london, 2nd rev.Edition, 1983.