		Indexing & Abstracting
Article	**Analysis of COVID-19 by Means of Graph Theory**	
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Online Published	June 2020	
Article DOI	https://doi.org/10.32350/sir.42.04	
QR Code of Article	Abaid ur Rehman	
Citation:	Virk A, Malik I. Analysis of COVID-19 by means of graph theory. *Sci Inquiry Rev.* 2020;4(2):48–65. Crossref	
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A publication of the
School of Science, University of Management and Technology
Lahore, Pakistan

Analysis of COVID-19 by Means of Graph Theory

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Abstract

Graph theory is a powerful computational method used in biological mathematics that deals with different biological issues. In the field of microbiology, graphs can communicate the sub-atomic structure where cell quality or protein can be indicated as the vertex and the associate component can be viewed as the edge. Thus, the properties of the biological activity of the cell can be measured via a topological index by comparing six graphs. The current article focuses on certain topological lists for the corona virus graph. Initially, a general type of M-polynomial was explored from the M-polynomial, we recouped eight well-known degree-based topological lists, for example, Randic´ Index, First and Second Zagreb Indices, General Randic´ Index, Second Modified Zagreb Index, Symmetric Division Index, Harmonic Index, Inverse Sum Index, and Augmented Zagreb Index. The results /conformed to the findings of the previous studies.

Introduction

Coronaviruses are a group of large, enveloped, positive standard RNA viruses that enters the windpipe, digestive system and central nervous system in humans and other animals 16 [1]. The spread of coronavirus in humans causes mild respiratory disease in humans [2]. During 2002-2004 17 SARS-CoV (Severe Acute Respiratory Syndrome) first rose in China and quickly spread to 18 parts of the world causing 8000 contaminations and as per a rough estimation passed around some 8000 related cases around 19 the world (WHO-2004). Further study reveals that SARS-CoV is transmitted from civet cats to humans. 20 In 2012 MERS-CoV (Middle East Respiratory Syndrome) was first recognized

in the Middle East and 21 afterwards spread to different nations. MERS-CoV transferred from dromedary camel to a human. In December 2019 that third Zoonotic human Coronavirus emerged in Wuhan, China after (SARS-CoV) 23 in 2002 and (MERS-CoV) in 2012. The causative agent is the novel coronavirus which is recognized 24 and separated from a solitary patient towards the beginning of January and accordingly was confirmed 25 in 16 extra patients [3]. Specifically a live animal and seafood whole sale 26 market in Wuhan, was regarded as the source of this novel coronavirus. As it is discovered 27 55 % cases were connected to the market place [4]. In the interim ongoing correlation of the genetic 28 sequences of this virus and bat coronavirus both show 96% similarity [5]. This virus rapidly spread in 29 China and subsequently all over the world.

The research paper focuses on finding M-Polynomial of m-level $COVID − 19$ graph

$CoV_{n,m}$. A $COVID − 19$ graph is defined as;

• n = No. of vertices of (Hemagglutinin+ Spikes+ RNA)
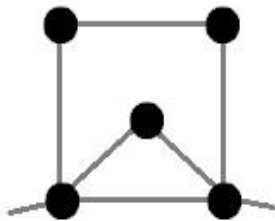• m= No. of viruses= No. of Envelop
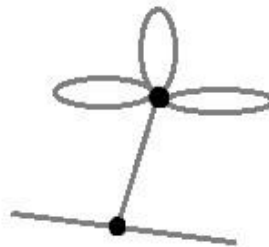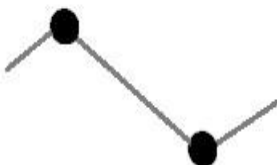
Where,

Figure 1. Hemagluttinin

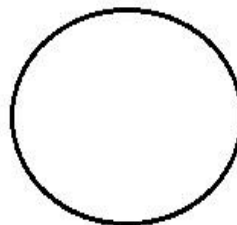
Figure 2. Spike

Figure 3. RNA

Figure 4. $CoV(16, 1)$

2. Molecular Graph Of $CoV_{(n,m)}$

2.1. Finite Graph

If we have 16 (Hemagglutinin+ Spikes+ RNA) and 1 (Envelop or Viruses) then $CoV_{(n,m)}$ graph 38 will be of the following form
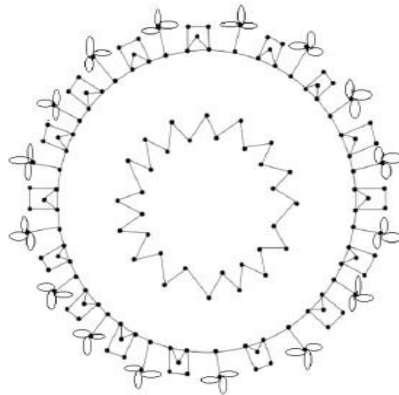

Figure 5. $CoV_{(n,m)}$

2.2. Infinite Graph

If we have n (Hemagglutinin+ Spikes+ RNA) and 1 (Envelop or Viruses) then $CoV_{(n,m)}$ graph 41 will be of form.
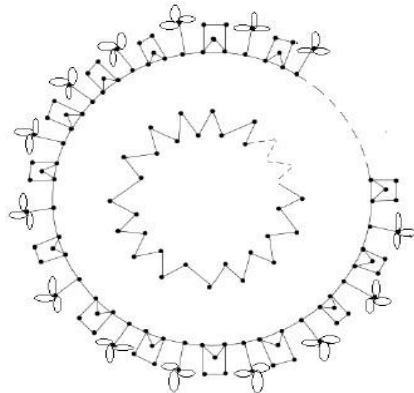

Figure 6. $CoV_{(n,1)}$

2.3. Infinite Graph of m-Viruses

If we have n (Hemagglutinin+ Spikes+ RNA) and m (Envelop or Viruses) then $CoV_{(n,m)}$ graph 44 will be of the following form
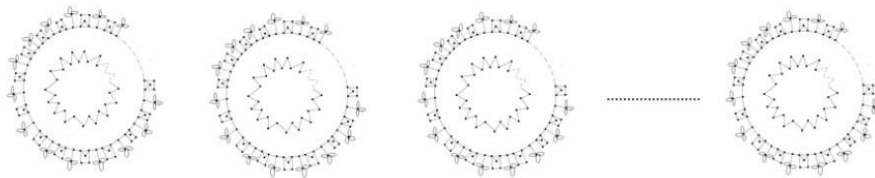
Figure 7. $CoV_{(n,m)}$

The information which is concealed in the symmetry of molecular graphs of various compounds can be studied by tools mathematical chemistry tools such as functions and polynomials. These help in predicting the properties of compounds without employing quantum mechanics. Topology of a graph can be described by topological index which is a numerical parameter. Topological indices give a numerical description of the molecular structure. This helps in developing a qualitative structure activity relationships (QSARs). Degree-based topological indices are the most well-known invariants of this type. These numerical values correlate the molecular structure with different aspects of properties such as chemical reactivity, physical properties and biological activities. It is a proven fact that the graphical structure of a molecule is correlated to its various properties such as boiling point, heat formation, rigidity and strain energy and fracture toughness [6].

A Graph is number of distinct dots and lines. These dots are called vertices and the lines/paths that connects these dot are called edges. The path between the two dots (vertices) like u and v are 58 known as length between the two vertices. Number of edges connected to a vertex are called degree 59 of the vertex. Degree of a vertex is a key point of finding an M-polynomial of our desired graph. 60 M-polynomial is use to find variations by changing our variables.

The tables of partition of a generalized $CoV_{(n,m)}$ graph consists of vertices, edges and loops given as

Table 1. Partition of $E(CoV_{(n,m)})$

Size of Edges	Degree of Vertices
$3n$	(2, 2)
$4n$	(2, 4)
$2n$	(3, 4)
n	(4, 4)
n	(3, 7)

Two parts are,

Vertices Set

$V_2 = \{CoV_{(n,m)}|dv = 5nm\}$

$V_3 = \{CoV_{(n,m)}|dv = nm\}$

$V_4 = \{CoV_{(n,m)}|dv = 2nm\}$

$V_7 = \{CoV_{(n,m)}|dv = nm\}$

Edge set

$$E_{2,2} = \left\{e = vu \in E\left(CoV_{n,m}\right)\,|\,d_u = 2, d_v = 2\right\} \rightarrow \left|E_{2,2}\right| = 3nm$$

$$E_{2,4} = \left\{e = vu \in E\left(CoV_{n,m}\right)\,|\,d_u = 2, d_v = 4\right\} \rightarrow \left|E_{2,4}\right| = 4nm$$

$$E_{3,4} = \left\{e = vu \in E\left(CoV_{n,m}\right)\,|\,d_u = 3, d_v = 4\right\} \rightarrow \left|E_{3,4}\right| = 2nm$$

$$E_{4,4} = \left\{e = vu \in E\left(CoV_{n,m}\right)\,|\,d_u = 3, d_v = 4\right\} \rightarrow \left|E_{4,4}\right| = nm$$

$$E_{3,7} = \left\{e = vu \in E\left(CoV_{n,m}\right)\,|\,d_u = 3, d_v = 4\right\} \rightarrow \left|E_{3,4}\right| = nm$$

Where,

• *m* denotes number of viruses.
• *n* denotes number of vertices.

3. M-Polynomial and Topological indices

Definition 1. Suppose $G=(V,E)$ is a graph and $v \in V$, then $d_v(G)$ denotes the degree of v. Let $m_{i,j}(G)$, $i, j =1$, be the number of edges uv of G such that $dv(G), du(G)= i, j$. The generalized graph G M-polynomial [7] can be given as :

$$M(G, x, y) = \sum m_{ij}(G)x^i y^j$$

$$\delta \leq i \leq j \leq \Delta$$

This polynomial has better computational characteristics of materials. Topological indices can be computed by utilizing this M-polynomial.

Definition 2. First and Second Zagreb indices was introduced by Gutman and Trinajstic [8, 9, 10] in 1972 and 1975 respectively. The 1st and 2nd Zagreb indices are stated as:

$$M_1(G) = \sum (d_u + d_v)$$

$$uv \in E(G)$$

$$M_2(G) = \sum (d_u d_v)$$

$$uv \in E(G)$$

Definition 3. The 2nd modified Zagreb index is stated as:

$$^m M_2(G) = \sum_{uv \in E(G)} \frac{1}{d_u d_v}$$

Definition 4. The RI is known as Randic´ Index which was introduced by Milan Randic´ in 1975. It is also called connectivity index of graph. [11]

$$R_\alpha(G) = \sum_{uv \in E(G)} \frac{1}{\sqrt{d_u d_v}}$$

where degree of vertices are represented by u and v.

Definition 5. The GRI is known as General Randic´ Index of G which was introduced by Ballobas,

Erdos [12] and Amic [13] in 1998. This index was equally popular in mathematics and chemistry [14].

$$RR_a(G) = \sum (dvdu)^\alpha$$

$$uveE(G)$$

where α is an any real number, αeR.[7]

Definition 6. Out of 148 discrete Adriatic indices, the total surface area for polychlorobiphenyls is predicted well by the Symmetric Division Index (SDI) [15]. For a connected graph G, SDI can be defined as given:

$$SDI(G) = \sum_{uv \in E(G)} \left(\frac{\min(d_u, d_v)}{\max(d_u, d_v)} + \frac{\max(d_u, d_v)}{\min(d_u, d_v)} \right)$$

Definition 7. The HI which is also known as Randic´ Index (H(G)) . It is alternate variant of Randic´ index which was introduced by Fajtlowicz [16] in 1987. It is stated as:

$$H(G) = \sum_{uv \in E(G)} \frac{2}{d_u + d_v}$$

Definition 8. The Inverse Sum Index (ISI) stated as:

$$ISI\left(G\right) = \sum_{uv \in E(G)} \frac{d_u d_v}{d_u + d_v} \text{ math}$$

Definition 9. The AZI known as Augmented Zagreb Index of G which was introduced by Boris

Furtula et al [17]. It stated as:

$$AZI\left(G\right) = \sum_{uv \in E(G)} \left(\frac{d_u d_v}{d_u + d_v - 2}\right)^3$$

It is valuable for computing heat of formation of alkanes. The calculation of residence of molecules (chemical and physical) can be viably categorized by these indices. Previously, Munir et al have calculated the M-polynomials. They also calculated corresponding topological indices for Titania Nanotubes in and Nanostar Dendrimers [17].

A few topological indices are degree based which can be determined from M-polynomial [12].

4. M-Polynomial of $CoV_{(n,m)}$

The algebraic polynomials of $COVID - 19$ raph are discussed below. Let us first compute 80 M-polynomial for $CoV_{n,m}$.

Theorem 10. *Let $CoV_{n,m}$ is generalized COVID-19 graph. Then*

$$M(CoV_{n,m}, x, y) = 3nmx^2y^2 + 4nmx^2y^4 + 2nmx^3y^4 + nmx^4y^4 + nmx^3y^7 \quad (1)$$

Proof.

$$M(CoV_{n,m}, x, y) = \sum_{i \leq j} m_{i,j}(CoV_{n,m})x^i y^j$$

$$= \sum_{2 \leq 2} m_{2,2}(CoV_{n,m})x^2 y^2 + \sum_{2 \leq 4} m_{2,4}(CoV_{n,m})x^2 y^4$$

$$+ \sum_{3 \leq 4} m_{3,4}(CoV_{n,m})x^3 y^4 + \sum_{4 \leq 4} m_{4,4}(CoV_{n,m})x^4 y^4$$

$$+ \sum_{3 \leq 7} m_{3,7}(CoV_{n,m})x^3 y^7$$

$$= \left|E_{2,2}\right|x^2 y^2 + \left|E_{2,4}\right|x^2 y^4 + \left|E_{3,4}\right|x^3 y^4$$

$$+ \left|E_{4,4}\right|x^4 y^4 + \left|E_{3,7}\right|x^3 y^7$$
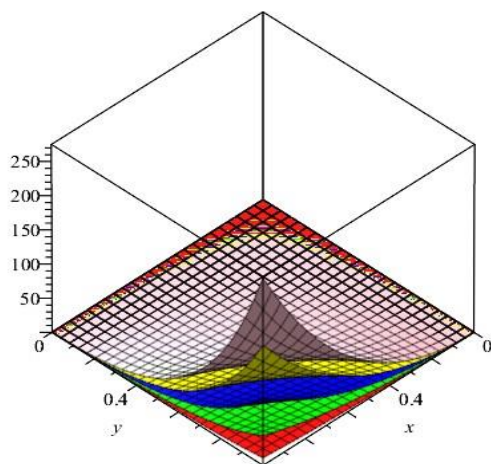
$$= 3nmx^2 y^2 + 4nmx^2 y^4 + 2nmx^3 y$$

Figure 8. $CoV_{(n,m)}$

Figure 8, shows the graphical representation of M-polynomial for $CoV_{(n,m)}$. Different colors are used for different values of x and y. The red color represents the values of y equal to 1. Similarly, green, blue, yellow and pink are fixed for x and y equal to 2, 3, 4 and 5, respectively.

5. Degree Based Topological Indices of $CoV_{(n,m)}$

Table 2. Induction of Some Degree Based Topological Indices from M-Polynomial

Topological Index	Derived form $M(CoV_{n,m}, x, y)$
1*st* Zagreb	$(Dx + Dy)[M(CoVn,m, x, y)]_{y=x=1}$
2*nd* Zagreb	$(DxDy)[M(CoV_n,m, x, y)]_{y=x=1}$
2*nd* Modified Zagreb	$(SxSy)[M(CoV_n,m, x, y)]_{y=x=1}$
General Randic´ (GR) $\alpha \in N$	$(Dx\alpha Dy\alpha)[M(CoVn,m, x, y)]y=x=1$
General Inverse Randic´ (GR)$\alpha \in N$	$(S^{\alpha}_{x}S_{y}^{\alpha})[M(CoVn,m, x, y)]_{y=x=1}$
Symmetric Division Index (SDI)	$(D_xS_y + D_yS_x)[M(CoV_n,m, x, y)]_{y=x=1}$
Harmonic Index (HI)	$2SxJ[M(CoVn,m, x, y)]_{y=x=1}$
Inverse Sum Index (ISI)	$SxJDxDy[M(CoVn,m, x, y)]_{y=x=1}$
Augmented Zagreb Index (AZI)	$S3xQ{-}2JDx3Dy3[M(CoVn,m, x, y)]y=x=1$

Where

$$D_x f = x \frac{\partial(f(x,y))}{\partial x}, D_y f = y \frac{\partial(f(x,y))}{\partial y}, S_x = \int_0^x \frac{f(y,t)}{t} dt, S_y = \int_0^y \frac{f(y,t)}{t} dt$$

J(f(x,y))=f(x,x),Q$_\alpha$(f(x,y))=x$^\alpha$f(x,y) for non-zero α

Theorem 11. *Let* $CoV_{n,m}$ *be generalized COVID − 19 graph. Then First Zagreb of COVID − 19 graph is given by,*

$$M_1(CoV_{n,m}) = 68nm$$

Proof. As we know that the M-polynomial of $CoV_{n,m}$ is defined in Eq (1), then First Zagreb is,

$M_1(CoV_n,m)= (D_x + D_y)[M(CoV_n,m, x, y)]_{x=y=1}$

$Dy= [6nmx^2y^2 + 16nmx^2y^4 + 8nmx^3y^4 + 4nmx^4y^4 + 7nmx^3y^7]$
$Dx= [6nmx^2y^2 + 8nmx^2y^4 + 6nmx^3y^4 + 4nmx^4y^4 + 3nmx^3y^7]$
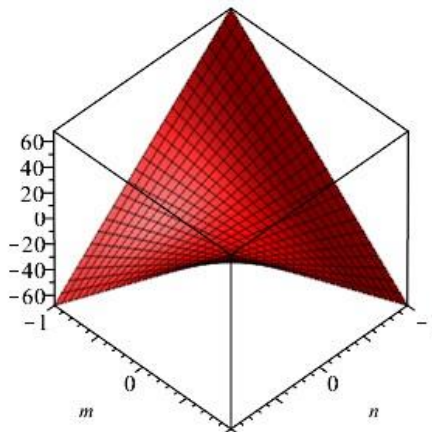$(Dx + Dy)x=y=1= 68nm$

Figure 9. 1st Zagreb index

Theorem 12. *Let* $CoV_{n,m}$ *be generalized COVID − 19 graph. Then Second Zagreb of Covid − 19 graph is given by,*

$$M_2(CoV_{n,m}) = 105nm$$

Proof. As M-polynomial of $CoV_{n,m}$ is defined in Eq (1), And D_x and D_y are defined in theorem 4.1,

Then Second Zagreb is,

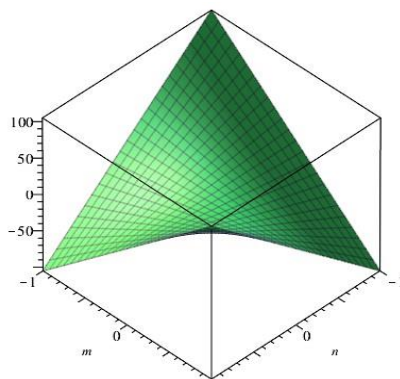$M_2(CoV_n,m)=(D_x \cdot D_y)[M(CoV_{n,m}, x, y)]_{y=x=1}=105nm$

Figure 10. 2st Zagreb index

Theorem 13. *Let* $CoV_{n,m}$ *be generalized* $COVID - 19$ *Graph. Then Second Modified Zagreb of* $COVID - 19$ *graph is given by,*
Zagreb is,

$$^{m}M_{2}\left(CoV_{n,m}\right) = (S_{x}S_{y})\Big[M\left(CoV_{n,m},x,y\right)\Big]_{x=y=1}$$

$$\left(D_{y}S_{x} + D_{x}S_{y}\right)_{x=y=1} = \frac{1047nm}{42}$$

$$^{m}M_{2}(CoV_{n},m) = \left(\frac{171nm}{112}\right)$$

Proof. As we know that the M-polynomial of wheel $CoV_{n,m}$ is defined in Eq (1), then Second Modified

$$S_{x}S_{y} = \frac{3nmx^{2}y^{2}}{4} + \frac{nmx^{2}y^{4}}{2} + \frac{3nmx^{3}y^{4}}{6} + \frac{3nmx^{4}y^{4}}{16} + \frac{3nmx^{3}y^{7}}{21}$$

$$(S_{x}S_{y})_{x=y=1} = \left(\frac{171nm}{112}\right)$$
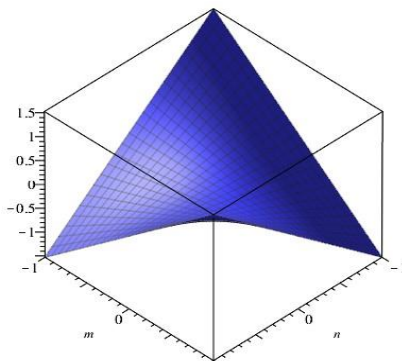

Figure 11. 2nd modified Zagreb index

Theorem 14. *Suppose $CoV_{n,m}$ be generalized COVID − 19 graph. Then General Randic´ of COVID − 19 graph is given by,*

$$GR(CoVn,m) = nm[4^\alpha \cdot 3 + 8^\alpha \cdot 4 + 12^\alpha \cdot 2 + 16^\alpha + 21^\alpha].$$

Proof. As we know that the M-polynomial of wheel $CoV_{n,m}$ is defined in Eq(1), then General Randic´ is,

$$GR(CoV_{n,m}) = (D_x^\alpha D_y^\alpha)[M(CoVn,m, x, y)]y=x=1$$

$$D_y^\alpha = (2)^\alpha \cdot 3nmx^2y^2 + (4)^\alpha \cdot 4nmx^2y^4 + (4)^\alpha \cdot 2nmx^3y^4 + (4)^\alpha \cdot nmx^4y^4 + (7)^\alpha nmx^3y^7$$

$$D_x^\alpha D_y^\alpha = (2)^\alpha \cdot (2)^\alpha \cdot 3nmx^2y^2 + (2)^\alpha \cdot (4)^\alpha \cdot 4nmx^2y^4 + (4)^\alpha \cdot (3)^\alpha \cdot 2nmx^3y^4 + (4)^\alpha(4)^\alpha \cdot nmx^4y^4 + (7)^\alpha \cdot (3)^\alpha nmx^3y^7$$

$$(D_x^\alpha D_y^\alpha)y=x=1 = (4)^\alpha \cdot 3nm + (8)^\alpha \cdot 4nm + (12)^\alpha \cdot 2nm + (16)^\alpha \cdot nm + (21)^\alpha \cdot nm$$
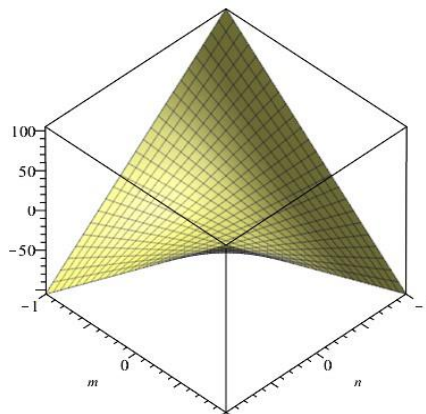

Figure 12. General Randic´ index

Theorem 15. *Suppose $CoV_{n,m}$ be generalized Covid − 19 graph, then General Inverse Randic´ of wheel graph is given by,*

$$RR_a(CoVn,m) = nm[\frac{3}{4^\alpha} + \frac{4}{8^\alpha} + \frac{2}{12^\alpha} + \frac{1}{16^\alpha} + \frac{1}{21^\alpha}]$$

Proof. As we know that the M-polynomial of $COVID − 19$ $CoV_{n,m}$ is defined in Eq(1), then General Inverse Randic´ is,

$$RR[CoV_{n,m}] = (S_x^\alpha S_y^\alpha) [M(CoV_n,m, x, y)]x=y=1$$

$$S_y^{\alpha} = \frac{3nmx^2y^2}{2^{\alpha}} + \frac{4nmx^2y^4}{4^{\alpha}} + \frac{2nmx^3y^4}{4^{\alpha}} + \frac{nmx^4y^4}{4^{\alpha}} + \frac{nmx^3y^7}{7^{\alpha}}$$

$$S_x^{\alpha}S_y^{\alpha} = \frac{3nmx^2y^2}{2^{\alpha}.2^{\alpha}} + \frac{4nmx^2y^4}{4^{\alpha}.2^{\alpha}} + \frac{2nmx^3y^4}{4^{\alpha}.3^{\alpha}} + \frac{nmx^4y^4}{4^{\alpha}.4^{\alpha}} + \frac{nmx^3y^7}{7^{\alpha}.3^{\alpha}}$$

$$\left(S_x^{\alpha}S_y^{\alpha}\right)_{x=y=1} = \frac{3}{4^{\alpha}} + \frac{4}{8^{\alpha}} + \frac{2}{12^{\alpha}} + \frac{1}{16^{\alpha}} + \frac{1}{21^{\alpha}}$$
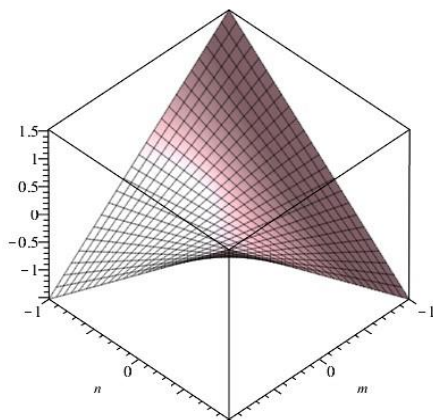

Figure 13. General inverse Randic´ index

Theorem 16. *Suppose $CoV_{n,m}$ be generalized COVID $-$ 19 graph, then Symmetric Division Index of COVID $-$ 19 graph is given by,*

$$SDI\left(CoV_{n,m}\right) = \frac{1047nm}{42}$$

Proof. As we know that the M-polynomial of $COVID - 19$ $CoV_{n,m}$ is defined in Eq (1), then

SDI is,

$$SDI(CoV_{n,m}) = (D_xS_y + D_yS_x)[M(CoV_n,m, x, y)]_{y=x=1}$$

$$D_yS_x = 3nmx^2y^2 + 8nmx^2y^4 + \frac{8nmx^3y^4}{3} + nmx^4y^4 + \frac{7nmx^3y^7}{3}$$

$$D_xS_y = 3nmx^2y^2 + 2nmx^2y^4 + \frac{3nmx^3y^4}{2} + nmx^4y^4 + \frac{3nmx^3y^7}{7}$$

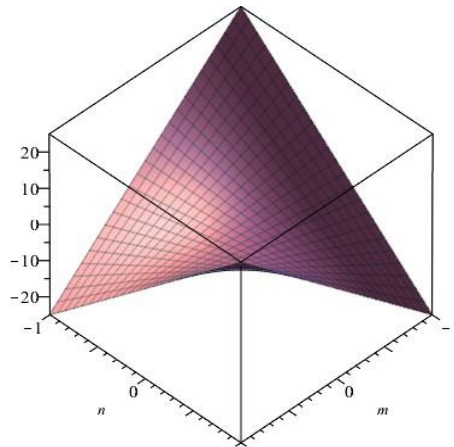$$\left(D_yS_x + D_xS_y\right)_{x=y=1} = \frac{1047nm}{42}$$

Figure 14. Symmetric Division Index (SDI)

Theorem 17. *Suppose $CoV_{n,m}$ be generalized $COVID-19$ graph, then Harmonic Index of $COVID-19$ graph is given by,*

$$HI\left(CoV_{n,m}\right) = \frac{1619nm}{420}$$

Proof. As we know that the M-polynomial of $COVID-19$ $CoV_{n,m}$ is defined in Eq(1),Then Harmonic index is

$$ISI\left(CoV_{n,m}\right) = S_x\left[J\left(D_xD_y\right)\right]\left[M\left(W_{n,m},x,y\right)\right]_{y=x=1}$$

$$E_{2,2} = \left\{e = vu \in E\left(CoV_{n,m}\right) | d_u = 2, d_v = 2\right\} \rightarrow \left|E_{2,2}\right| = 3nm$$

$$E_{2,4} = \left\{e = vu \in E\left(CoV_{n,m}\right) | d_u = 2, d_v = 4\right\} \rightarrow \left|E_{2,4}\right| = 4nm$$

$$E_{3,4} = \left\{e = vu \in E\left(CoV_{n,m}\right) | d_u = 3, d_v = 4\right\} \rightarrow \left|E_{3,4}\right| = 2nm$$

$$E_{4,4} = \left\{e = vu \in E\left(CoV_{n,m}\right) | d_u = 3, d_v = 4\right\} \rightarrow \left|E_{4,4}\right| = nm$$

$$E_{3,7} = \left\{e = vu \in E\left(CoV_{n,m}\right) | d_u = 3, d_v = 4\right\} \rightarrow \left|E_{3,4}\right| = nm$$

$$S_xJ\left[M\left(CoV_{n,m},x,x\right)\right] = \frac{3nmx^4}{4} + \frac{2nmx^6}{3} + \frac{2nmx^7}{7} + \frac{nmx^8}{8} + \frac{nmx^{10}}{10}$$

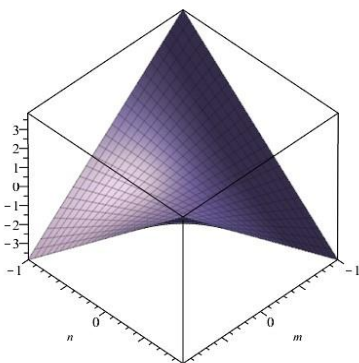$$2S_xJ\left[M\left(CoV_{n,m},x,y\right)\right] = \frac{1619nm}{420}$$

Figure 15. Harmonic index

Theorem 18. *Suppose $CoV_{n,m}$ be generalized $COVID - 19$ graph, then Inverse Sum Index of $COVID - 19$ graph is given by*

$$ISI\left(CoV_{n,m}\right) = \frac{3331nm}{210}$$

Proof. As we know that the M-polynomial of $CoV_{n,m}$ $CoV_{n,m}$ is defined in Eq (1), then Inverse Sum Index is

$$ISI\left(CoV_{n,m}\right) = S_x\left[J\left(D_xD_y\right)\right]\left[M\left(W_{n,m},x,y\right)\right]_{y=x=1}$$

$$D_xD_y = 12nmx^2y^2 + 32nmx^2y^4 + 24nmx^3y^4 + 16nmx^4y^4 + 21nmx^3y^7$$

$$J\left(D_xD_y\right) = 12nmx^4 + 32nmx^6 + 24nmx^7 + 16nmx^8 + 21nmx^{10}$$

$$S_xJ\left(D_xD_y\right) = 3nmx^4 + \frac{16nmx^6}{3} + \frac{24nmx^7}{7} + 2nmx^8 + \frac{21nmx^{10}}{10}$$

$$S_xJ\left(D_xD_y\right)\left[M\left(CoV_{n,m},x,y\right)\right]_{y=x=1} = \frac{3331nm}{210}$$
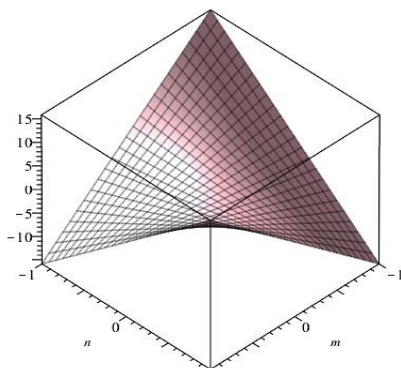

Figure 16. Inverse Sum index

Theorem 19. *Suppose* $CoV_{n,m}$ *be generalized COVID − 19 graph, then Augmented Zagreb Index of*

COVID − 19 graph is given by,

$$AZI\left(CoV_{n,m}\right) = 120\frac{1747nm}{2500}$$

Proof. As we know that the M-polynomial of *COVID − 19* $CoV_{n,m}$ is defined in Eq (1), then

Augmented Zagreb Index is,

$$AZI\left(CoV_{n,m}\right) = S_x^3 Q_{-2} J D_x^3 D_y^3 \left[M\left(CoV_{n,m}, x, y\right)\right]_{x=y=1}$$

$$D_y^3 = (2)^3 . 3nmx^2 y^2 + (4)^3 . 4nmx^2 y^4 + (4)^3 . 2nmx^3 y^4 + (4)^3 . nmx^4 y^4 + (7)^3 . 3nmx^3 y^7$$

$$D_x^3 D_y^3 = (4)^3 . 3nmx^2 y^2 + (8)^3 . 4nmx^2 y^4 + (12)^3 . 2nmx^3 y^4 + (16)^3 . nmx^4 y^4 + (21)^3 . 3nmx^3 y^7$$

$$J\left(D_x^3 D_y^3\right) = 192nmx^4 + 2048nmx^6 + 3456nmx^7 + 4096nmx^8 + 9261nmx^{10}$$

$$Q_{-2}J\left(D_x^3 D_y^3\right) = 192nmx^2 + 2048nmx^4 + 3456nmx^5 + 4096nmx^6 + 9261nmx^8$$

$$S_x^3 Q_{-2} J D_x^3 D_y^3 \left[M\left(CoV_{n,m}, x, y\right)\right]_{x=y=1} = 120\frac{1747nm}{2500}$$
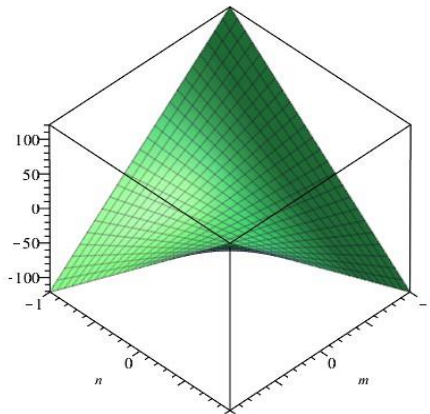

Figure 17. Augmented Zagreb index

6. Conclusion

The graph theory is the discipline of mathematics which reinforces the investigation of complex networks in biological application or in any other uses. It has been effectively used in the investigation of the biological network topology and different biomolecules. Thus

topological indices help in understanding the chemical reactivity, physical features and biological activities. Hence, it can be said that the topological indices are a core function. Every molecular structure can be mapped to a real number with its help. It can also be used asdescriptors of the molecules under testing. In this paper the M-polynomial of coronavirus is proposed. From M-polynomial we find some degree based topological indices such as Modified Second Zagreb Index, First and Second Zagreb Indices, Augmented Zagreb and Symmetric Division Index.

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