iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** I **Month of publication:** January 2026

DOI: https://doi.org/10.22214/ijraset.2026.76855

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue I Jan 2026- Available at www.ijraset.com

Color Class Dominating Sets on Regular Graphs of Degree 5

Dr. A. Vijayalekshmi, S. G. Vidhya
[1]*Associate Professor,* [2]*Research Scholar, Department of Mathematics, S.T. Hindu College,Nagercoil – 629002, Tamil Nadu, India*
(Affiliated to ManonmaniamSundaranar University, Tirunelveli – 627012)

***Abstract:** Let $G = (V, E)$be a graph. A color class dominating set of G is a proper coloring $\mathcal{C}$ of G with extra property that every color class in $\mathcal{C}$ is dominated by a vertex in G. A color class dominating set is said to be minimal color class dominating set if no proper subset of $\mathcal{C}$ is a color class dominating set of G. The color class domination number of G is the minimum cardinality taken over all minimal color class dominating sets of G and is denoted by $\gamma_\chi(G)$. Here we also obtain $\gamma_\chi(G)$ of regular graph degree 5.*

***Keywords:** Chromatic number, Domination number, Color Class Dominating set, Color Class Domination number.*
***Mathematics subject classification:** 05C15, 05C69*

I. INTRODUCTION

All graphs considered in this paper are finite, undirected graphs and we follow standard definitions of graph theory [2]. Let $G = (V, E)$be a graph of order p. The open neighborhood $N(v)$of vertex$v \in V(G)$consist of the set of all vertices adjacent to v. The closed neighborhood of v is $N[v] = N(v) \cup \{v\}$. For a set $S \subseteq V$, the open neighborhood $N(S)$is defined to be $\cup_{v \in S} N(v)$, and the closed neighborhood of S is$N[S] = N(S) \cup S$ for any subset H of vertices of G, the induced sub graph $< H >$ is the maximal sub graph of G with vertex set H. A subset S of V is called a dominating set if every vertex in $V - S$ is adjacent to some vertex in S. A dominating set Sis called a minimal dominating set if no proper subset of S is a dominating set of G. The domination number $\gamma(G)$is the minimum cardinality taken over all minimal dominating sets of G. A γ- set is any minimal dominating set with cardinalityγ. A proper coloring of G is an assignment of colors to the vertices of G such that adjacent vertices have different colors.The smallest number of colors for which there exists a proper coloring of G is called chromatic number of $G$and is denoted by$\chi(G)$. A color class dominating set of G is a proper coloring $\mathcal{C}$ of G with the extra property that every color class in $\mathcal{C}$ is dominated by a vertex in G.A color class dominating set is said to be a minimal color class dominating set if no proper subset of $\mathcal{C}$is a color class dominating set of G. The color class domination number of G is the minimum cardinality taken over all minimal color class dominating set of G and is denoted by$\gamma_\chi(G)$. This concept was introduced by Vijayalekshmi et al [2].A graph G is said to be r-regular if degree of each vertex of G is r. A 3-regular graph is also called a cubic graph. In this paper we obtain color class domination of regular graphs of degree 5.

II. MAIN RESULTS

Theorem 2.1

Let G be a regular graph of degree 5then$\gamma_\chi(G)$=$\frac{n}{2}$ or $\left(\frac{n}{2}\right) - 2$**Proof:**Let G be the regular graph of degree 5 with order $n = 2p$ and Let $V(G) = \{v_1, v_2, v_3 \dots \dots \dots \dots v_p \dots . v_n\}$.We consider 2 cases

Case (i) Graph with triangles

$N(v_1) = \{v_2, v_p, v_{p+1}, v_{p+2}, v_n\}$,$N(v_p) = \{v_1, v_{p-1}, v_{p+1}, v_{n-1}, v_n\}$,

$N(v_{p+1}) = \{v_1, v_2, v_p, v_{p+2}, v_n\}$, $N(v_n) = \{v_1, v_{p-1}, v_p, v_{p+1}, v_{n-1}\}$,$N(v_i) = \{v_{i-1}, v_{i+1}, v_{i+p-1}, v_{i+p}, v_{i+p+1}\}, 2 \le i \le p - 1$ and $N(v_j) = \{v_{j-1}, v_{j+1}, v_{j-p-1}, v_{j-p}, v_{j-p+1}\}, p + 2 \le j \le n - 1$

Assign distinct colors say 1,2 and 3 to the vertices $\{v_1, v_{n-1}\}, \{v_2, v_n\}$ and $\{v_3, v_{p+1}\}$ respectively. Also assign distinct colors, say i($4 \le i \le \frac{n}{2}$) to the vertices $\{v_i, v_{p+(i-2)}\}$ we obtain the γ_χ coloring of G. Thus $\gamma_\chi(G) = \frac{n}{2}$

Illustration:(G_{26})

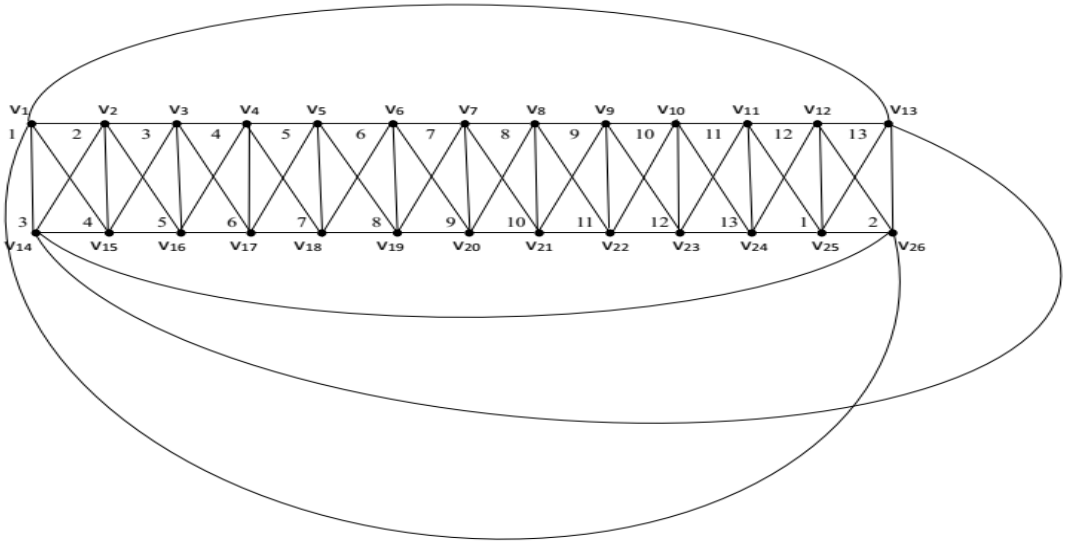


Figure 1

$$\gamma_{\chi}(G_{26}) = 13$$

Case (ii)A graph without triangles

Let $N(v_1) = \{v_2, v_3, v_{16}, v_{p+1}, v_{p-1}\} N(v_i) = \{v_{i-2}, v_{i-1}, v_{i+1}, v_{i+2}, v_{p+(i-1)}\}$ for $i = \{3,5, \dots \dots \dots \dots (n-1)\}$. $N(v_i) = \{v_{i-2}, v_{i-1}, v_{i+1}, v_{i+2}, v_{p+i}\}$ for $3 \leq i \leq p$ and$N(v_i) = \{v_{i-2}, v_{i-1}, v_{i+1}, v_{i+2,} v_{i-p}\}$ for $p + 1 \leq i \leq n$

Assign distinct colors $i(1 \leq i \leq 4)$ to the vertices say $\{v_i, v_{i+4}, v_{i+p+2}\}$ respectively

Assign distinct colors $i(5 \leq i \leq \left(\frac{n}{2}\right) - 2)$ to the vertices $\{v_{i+(p-11)}, v_{p+(i+2)}\}$ respectively. we get γ_{χ} coloring of G.Thus$\gamma_{\chi}(G) = \left(\frac{n}{2}\right) - 2$.

Illustration:(G_{16})

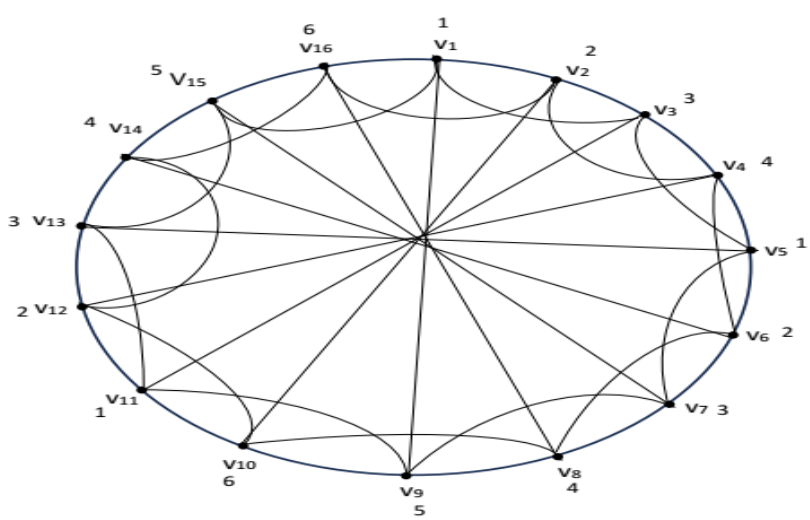
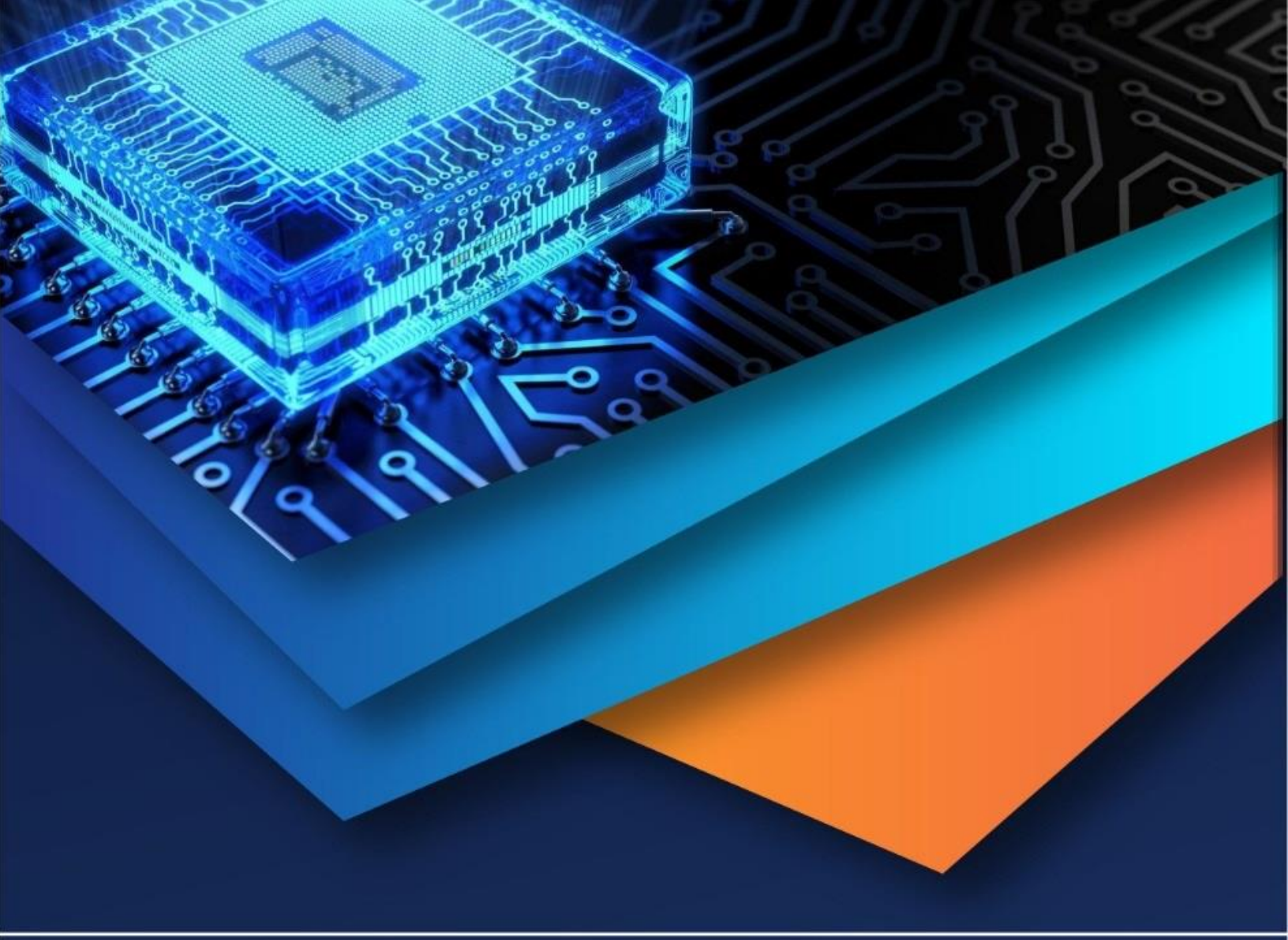


Figure 2

$$\gamma_{\chi}(G_{16}) = 6$$

REFERENCES

[1] A. Vijayalekshmi, Total dominator colorings in graphs, International Journal of Advancements in Research Technology, Vol. 1, No. 4, pp. 1-6, 2012.
[2] A. Vijayalekshmi and A.E. Prabha, Introduction of color class dominating set in Graphs, Malaya Journal of Mathematik, Vol. 8, No. 4, pp. 2186-2189, 2020.
[3] A. Vijayalekshmi and S.G. Vidhya, Color class dominating sets in path and cycle related graphs Malaya Journal of Matematik, Vol. 09, No. 01, 1237-1240, 2021
[4] A. Vijayalekshmi and P. Niju, An Introduction of Dominator color class dominating sets in Graphs, Malaya Journal of Matematik, Vol.9, No.1, pp. 1015-1018, 2021.
[5] A. Vijayalekshmi and J. VirjinAlangara Sheeba, Total Dominator Chromatic Number of Paths Cycles and Ladder graphs, International Journal of Contemporary Mathematical Sciences, Vol. 13, No. 5, pp. 199–204, 2018.
[6] A. Vijayalekshmi and S. Anusha, Dominator Chromatic Number on Various Classes of Graphs, International Journal of Scientific Research and Reviews, Vol. 9, No. 3, pp. 91–01, 2020.
[7] A. Vijayalekshmi and S.G. Vidhya, Dominator color class dominating sets in triangular ladder and mobius ladder graphs, Malaya Journal of Matematik, Vol. 09, No. 01, 1241-1243, 2021
[8] F. Harrary, Graph Theory, Addition – Wesley Reading Mass, 1969.
[9] A. Vijayalekshmi and S.G. Vidhya, Dominator color class dominating sets in Grid graphs Journal of Computational Analysis and Applications, Vol. 33, No. 08, 385-389, 2024
[10] Terasa W. Haynes, Stephen T. Hedetniemi, Peter J Slater, Determination in Graphs, Maral Dekker, New York, 1998.
[11] A. Vijayalekshmi and A.E.Prabha, Color class dominations sets in various classes of Graphs, Malaya Journal of Matematik, Vol. 9, No. 1, pp. 195-198, 2021
[12] A.E. Prabha and A. Vijayalekshmi, 'Color class dominating sets in ladder and grid Graphs, Malaya Journal of Matematik, Vol. 9, No. 1, 993-995, 2021
[13] A.E. Prabha and A. Vijayalekshmi, Color Class Dominating Sets on Cartesian Product of Path and Cycle Related Graphs, Adalya Journal, Vol. 9, No. 7, pp. 16-25, 2022
[14] P. Niju and A. Vijayalekshmi, Color Class Dominating sets in Open Ladder and Slanting Ladder Graphs, International Journal of New Innovations in Engineering and Technology, Vol. 17, No. 1, pp. 57-61, 2021.
[15] A. Vijayalekshmi and P. Niju, Color Class Dominating sets in Umbrella Graph and Dutch Windmill Graphs, Infokara research, Vol. 10, No. 12, pp. 38-48, 2021



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)