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Color Class Dominating Sets on Regular Graphs of Degree 5

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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 $\cup_{v \epsilon S} N(v)$, 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})

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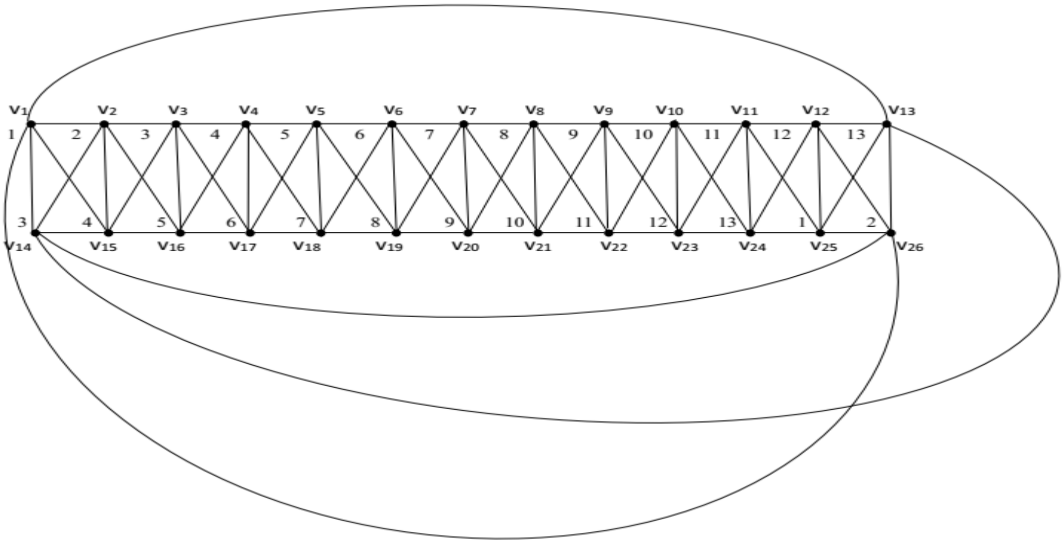

Figure 1

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

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 $i = \{3,5, \ldots \ldots . \ldots \ldots . (n-1)\}$. $N(v_i) = \{v_{i-2}, v_{i-1}, v_{i+1}, v_{i+2}, v_{p+i}\}$ for $3 \le i \le p$ and$N(v_i) = \{v_{i-2}, v_{i-1}, v_{i+1}, v_{i+2,} v_{i-p}\}$ for $p + 1 \le i \le n$

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

Assign distinct colors $i(5 \le i \le \left(\frac{n}{2}\right) - 2)$ 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})

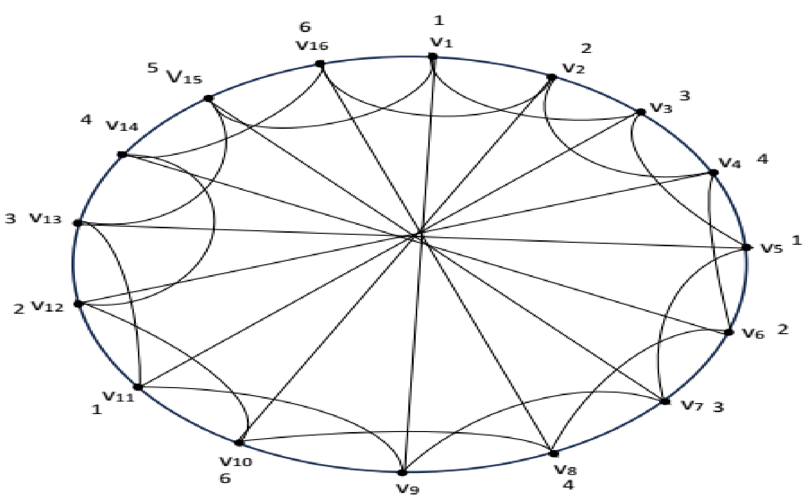

Figure 2

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

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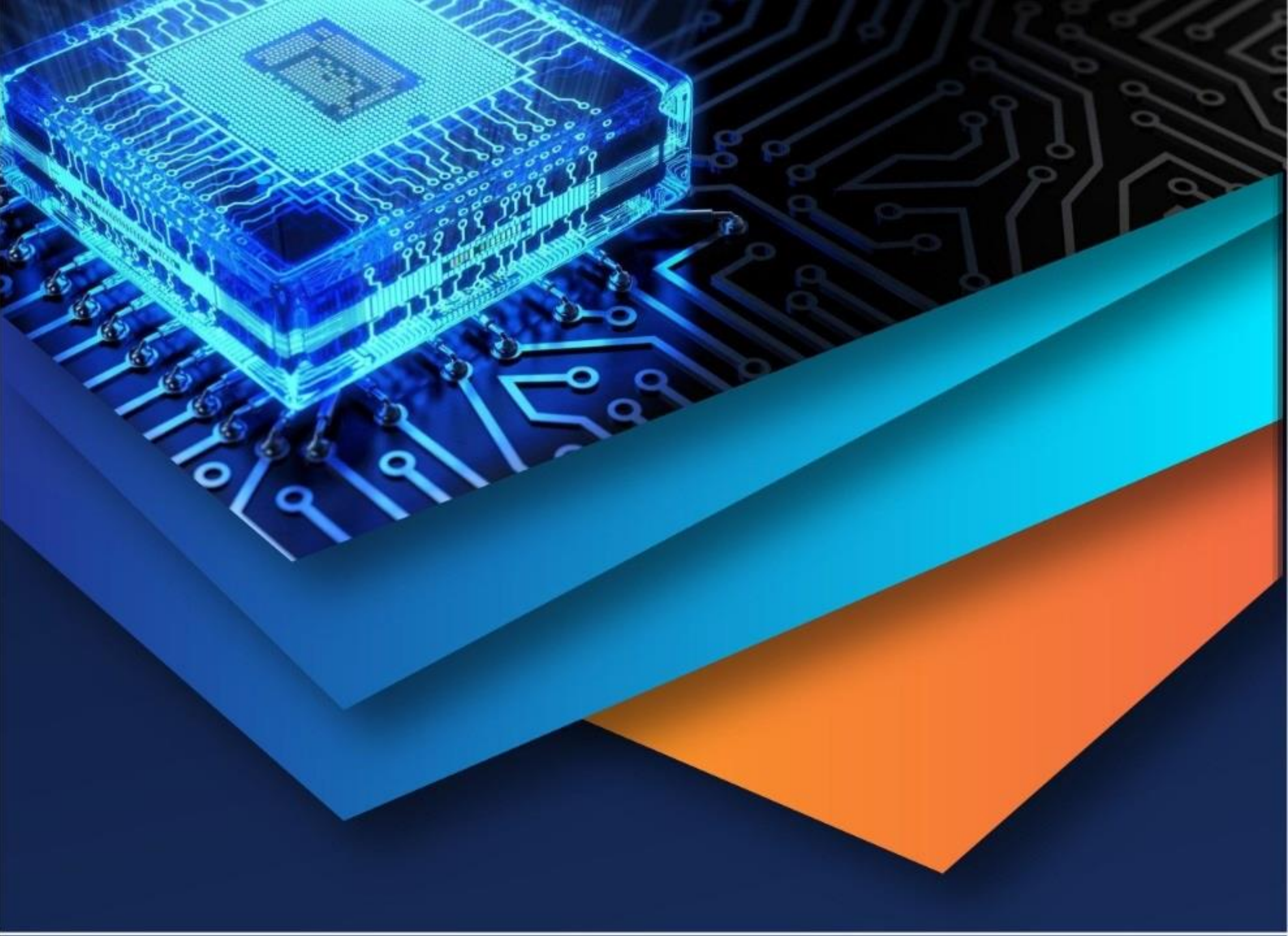

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