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Study of Physico-Chemical Characteristics of Groundwater around Kala Nala basin, Ichalkaranji, Kolhapur, Maharashtra, India

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Abstract: Groundwater is one of the most important natural resource. It is a widely used for drinking in both the rural and urban areas. The groundwater quality, however in recent time has got deteriorated due to the percolation of polluted water in to the soils from the wastewater drains, polluted river sand ponds. The present study reveals the groundwater quality of Kala Nala basin in the Ichalkaranji, Kolhapur. In that, The Piper Trilinear diagram the chemical quality of dug well, bore well and surface water samples of Kala Nala basin, reveals that, 25% samples of pre and post-monsoon seasons represent HCO3 + CO3 type, 41.67% Ca(Mg)HCO3 type and 33.33% Na(K)HCO3 type of hydro chemical facies. Based on U.S. Salinity diagram groundwater samples of post-monsoon season and pre-monsoon season, 25% samples are fall in C4 – S3 field, 75% samples are in C4 – S2 field and 25% samples are fall in C4 – S3 field, 25% samples are in C4 – S2 and 50% samples are fall in C3 – S2 field respectively. The water sample shows result of medium to very high salinity hence water is unsuitable for irrigation purpose. The Gibbs variation diagrams of pre and post-monsoon seasons suggest the chemistry of groundwater is controlled by precipitation dominance

***Keywords:** Groundwater quality, Social Awareness.*

I. INTRODUCTION

Groundwater is one of the prime sources of fresh water. It is an important source of drinking water for the Water pollution is increasing steadily due to rapid population growth, industrial proliferations, urbanize Ground water contamination is generally irreversible i.e. once it is contaminated; it is difficult tore store the original water quality of the aquifer. Excessive mineralization of groundwater degrades its quality and produces an objectionable taste, odour and excessive hardness. Although the soil mantle through which water passes acts as an adsorbent retaining a large part of colloidal and soluble ions with its cation exchange capacity, but ground water is not completely free from the menace of chronic pollution. Therefore, it is always better to protect ground water in the first place rather than relying on technology to clean up contaminated water at a later stage. India is developing country which means infrastructure sector is growing on at a much higher rate, leads to the development of core industries like metals, chemicals, fertilizers, drugs and petroleum etc. and other industries such as plastics, pesticides, detergents, solvents, paints, dyes, and food disposed their effluents and emissions on land and water bodies and polluting our environment.

II. STUDY AREA

The study area is bounded between latitude N 16.685 to N 16.672 & N 16.757 to N 16.663 and longitude E 74.458 to E 74.491 & E 74.478 to E 74.483, in Survey of India Toposheet numbers 47 L/6, on scale 1:50000. The area is covered by Deccan trap of Upper Cretaceous to Lower Eocene in age. The main source of water for drinking, irrigation and industrial purposes is from dug wells, bore wells and surface water.

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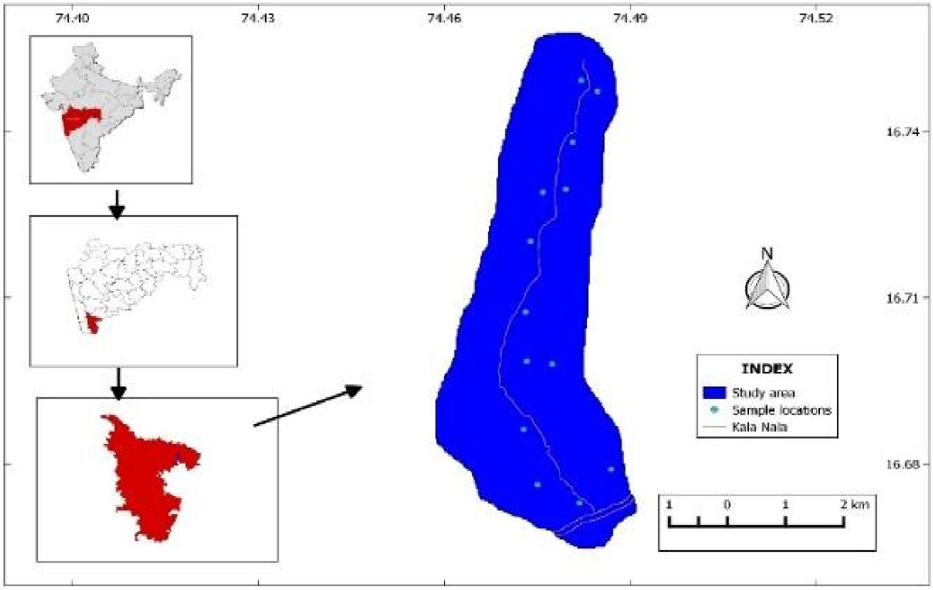

Fig.1: Study Area with sample locations

III. METHODOLOGY

For the appraising of groundwater quality, representative 25 water samples were collected in pre-monsoon and post monsoon seasons. The samples were collected in one-litter plastic bottles. The various physio -chemical parameters were analysed by following the standard procedures given in standard methods for the examination of water and waste water (APHA, AWWA, WPCF [2]; Trivedy and Goel[13]) Table No. 1 and 2. Concentration of different chemical parameters of dug well, bore well and surface water samples are shown in table no. I & II.

TABLE I : Concentration of different chemical parameters of water samples of study area (Post-monsoon)

SAMPLE NO	PH	ECμs/cm	THmg/lit	TAmg/lit	TDSmg/lit	Ca	Mg	Na	K	CO3	HCO3	SO4	CL
SW-01	9.80	1893	14.4	390	15.63	112.22	60.91	221.58	18.59	0	400	151.52	8.9
SW-02	8.50	2128	8.9	480	17.37	88.17	36.54	303.22	19.06	0	510	75.76	9.7
SW-03	9.75	1478	23	330	12.2	87.18	35.04	218.25	5.75	0	480	91.12	22
SW-04	10.20	1800	20.5	300	14.86	100.2	104.76	163.27	3.43	0	490	121.21	10.6
SW-05	9.60	2200	35.1	340	18.17	64.128	29.23	198.26	16.88	0	350	136.36	8.3
SW-06	10.80	1801	24.3	370	15.4	200.4	104.76	198.26	3.91	0	360	257.58	14.3
DW-01	9.55	1980	16.2	400	16.35	120.26	78.14	220.14	7.18	0	380	220.53	12.5
DW-02	8.80	2004	11.2	340	16.53	88.17	48.72	314.88	0.73	20	420	166.67	8.6
DW-03	9.65	1905	11.3	460	15.73	110.2	55.2	225.3	2.22	0	386	225.23	6.5
BW-01	10.75	1805	14.1	430	14.9	89.25	65.23	169.56	10.23	0	320	198.85	12.5
BW-02	9.70	1637	8.4	350	13.52	114.45	60.52	180.85	6.5	0	396	221.85	9
BW-03	9.40	1695	8.6	370	14	98.52	107.45	219.12	3.6	0	360	222.2	5.4
BW-04	10.30	1991	27.3	398	16.44	86.45	145.2	278.2	7.8	0	410	245.2	11

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TABLE III: Concentration of different chemical parameters of water samples of study area (Pre-monsoon)

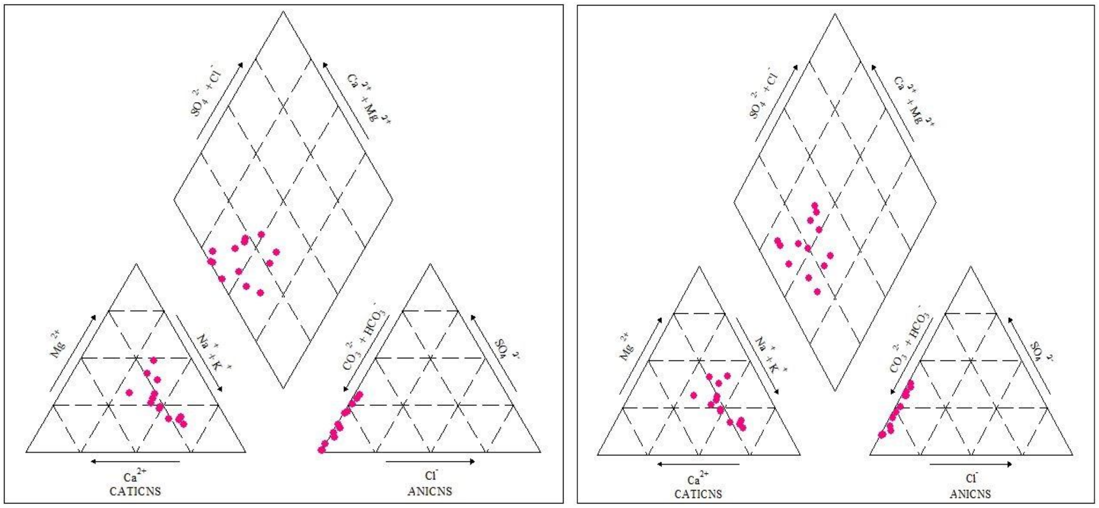
SAMPLE NO	PH	ECµs/cm	THmg/lit	TAmg/lit	TDSmg/lit	Ca	Mg	Na	K	CO3	HCO3	SO4	CL
SW-01	8.20	1904	17.3	430	16.43	114.26	62.24	231.27	19.69	0	470	155.2	9.5
SW-02	9.35	2286	9.5	510	19.52	90.42	38.55	307.35	20.4	0	520	77.12	9.9
SW-03	10.20	1582	27	360	13.7	89.2	37.2	220.24	6.85	0	510	92.56	23
SW-04	11.40	1986	21.4	310	15.46	101.52	106.7	165.35	4.33	0	490	123.86	11.7
SW-05	8.75	2375	37.2	380	19.2	66.78	31.2	202.36	17.44	0	360	137.23	9.4
SW-06	11.20	1929	25.4	410	16.6	204.38	106.25	199.46	4.95	0	420	258.4	15.3
DW-01	10.80	2076	18.3	460	17.87	128.45	79.3	223.14	8.28	0	410	239.5	13.8
DW-02	9.60	2069	12.8	380	17.46	90.18	51.6	316.2	0.87	30	430	168.2	9.6
DW-03	10.70	2040	12.4	530	16.68	112.4	57.38	226.8	3.24	0	398	227.82	7.5
BW-01	11.80	1936	15.1	580	15.4	90.4	66.28	170.3	11.32	0	330	199.6	13.6
BW-02	10.20	1782	9.4	480	14.45	116.38	61.49	190.95	8.5	0	410	223.45	10
BW-03	10.50	1784	9.7	430	26	99.54	109.85	220.32	4.7	0	380	223.3	5.7
BW-04	11.85	2095	28.6	490	17.28	89.4	147.27	188.4	8.9	0	430	246.8	12

IV. RESULT & DISCUSSION

From the Fig. 2.a - b, it is observed that 13 water samples (100%) of pre-monsoon and post-monsoon seasons belongs

A. Classification of groundwater based on Piper Trilinear diagram

In order to understand the variation in hydro chemical facies with time and space, the data of chemical analyses of dug on the Piper Trilinear diagram. (Fig.1.a-b) Pipers Trilinear diagrams indicate that, the 25% samples of pre and post-monsoon seasons represent HCO3 + CO3 type, 41.67% Ca(Mg)HCO3 type and 33.33% Na(K)HCO3 type hydro chemical facies.



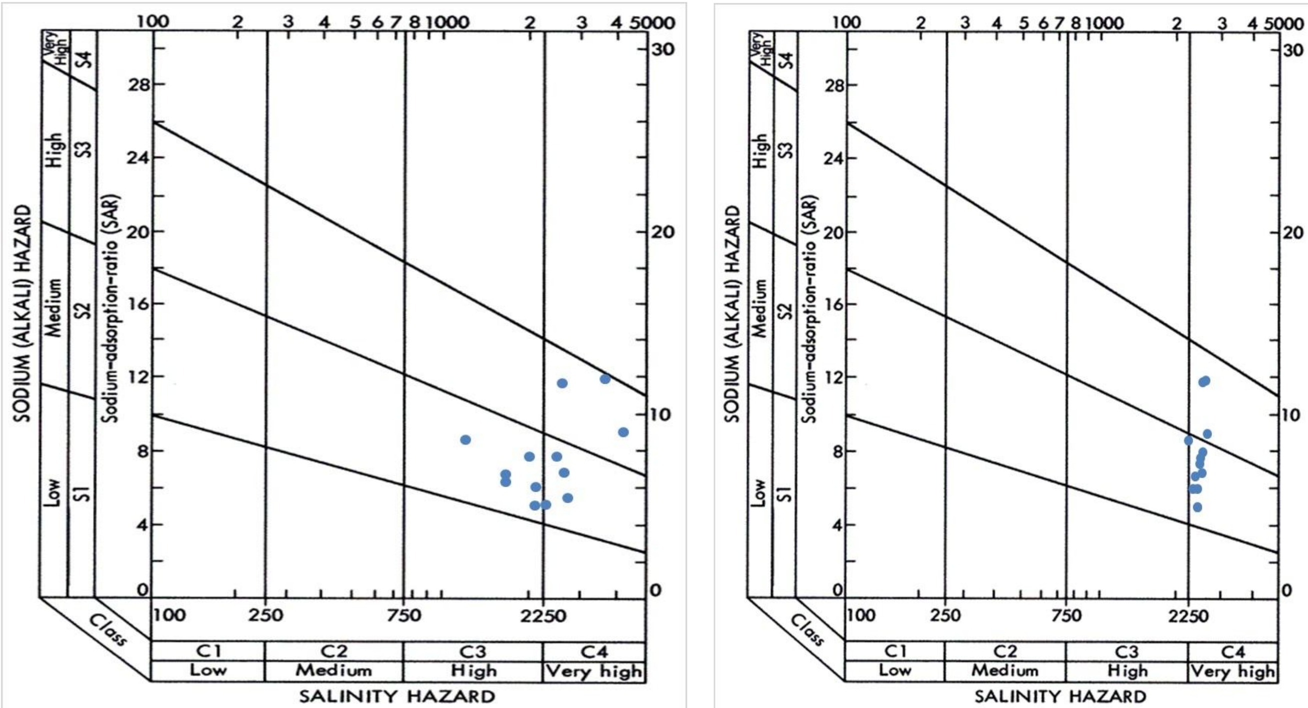
(a) Pre-monsoon (b) Post-monsoon

Fig.2.a-b : Piper Trilinear diagram from water samples of the study area

B. Classification of groundwater based on U. S. Salinity diagram

On the basis of U.S. Salinity diagram (Fig.3.a-b) groundwater samples of post-monsoon season 25% samples are fall in C4 – S3 field and 75% samples are in C4 – S2 field. The water sample shows result of high to very high and medium to very high salinity hence water is unsuitable for irrigation purpose.

On the basis of U.S. Salinity diagram groundwater samples of pre-monsoon season 25% samples are fall in C4 – S3 field 25% samples are in C4 – S2 and 50% samples are fall in C3 – S2 field. The water sample shows result of high to very high, high to very high and medium to high salinity hence water is unsuitable for irrigation purpose.

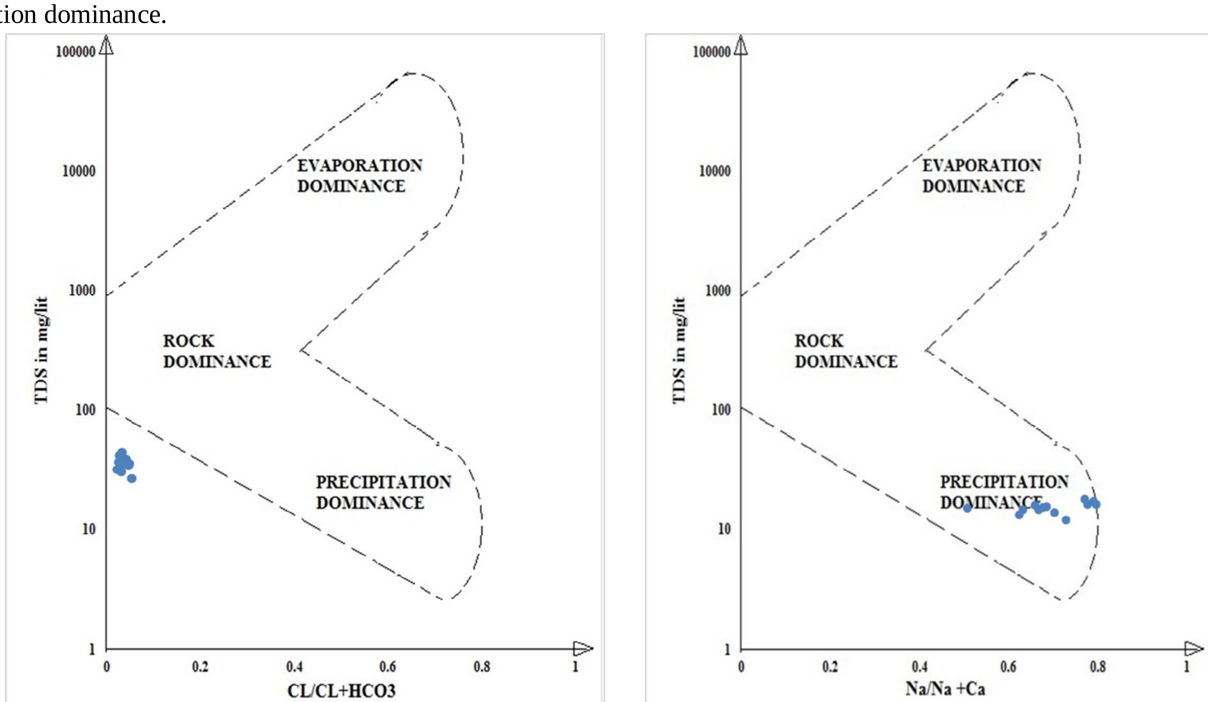


(a)Post-monsoon (b)Pre-monsoon

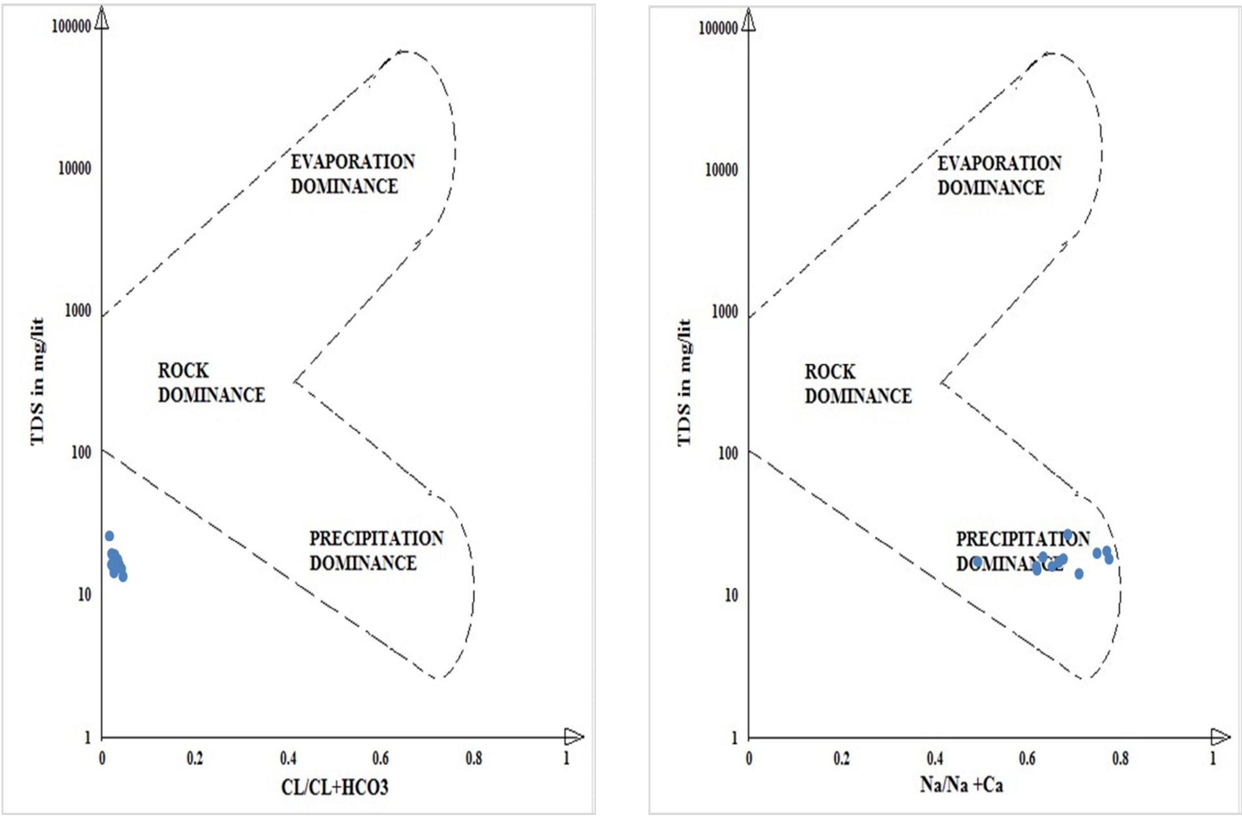
Fig.2.a-b : Classification of irrigation suitability with USSL Diagram

C. Classification of groundwater based on Gibbs Variation diagram

The Gibbs variation diagrams (Fig.3.a-b) of pre and post-monsoon seasons suggest the chemistry of groundwater is controlled by precipitation dominance.



(a) Post-monsoon



(b) Pre-monsoon

V. CONCLUSIONS

On the basis of Piper Trilinear diagram the chemical quality of dug well, bore well and surface water samples of Kala Nala basin, reveals that, 25% samples of pre and post-monsoon seasons represent HCO3 + CO3 type, 41.67% Ca(Mg)HCO3 type and 33.33% Na(K)HCO3 type of hydro chemical facies. Based on U.S. Salinity diagram groundwater samples of post-monsoon season and pre-monsoon season, 25% samples are fall in C4 – S3 field, 75% samples are in C4 – S2 field and 25% samples are fall in C4 – S3 field, 25% samples are in C4 – S2 and 50% samples are fall in C3 – S2 field respectively. The water sample shows result of medium to very high salinity hence water is unsuitable for irrigation purpose. The Gibbs variation diagrams of pre and post-monsoon seasons suggest the chemistry of groundwater is controlled by precipitation dominance.

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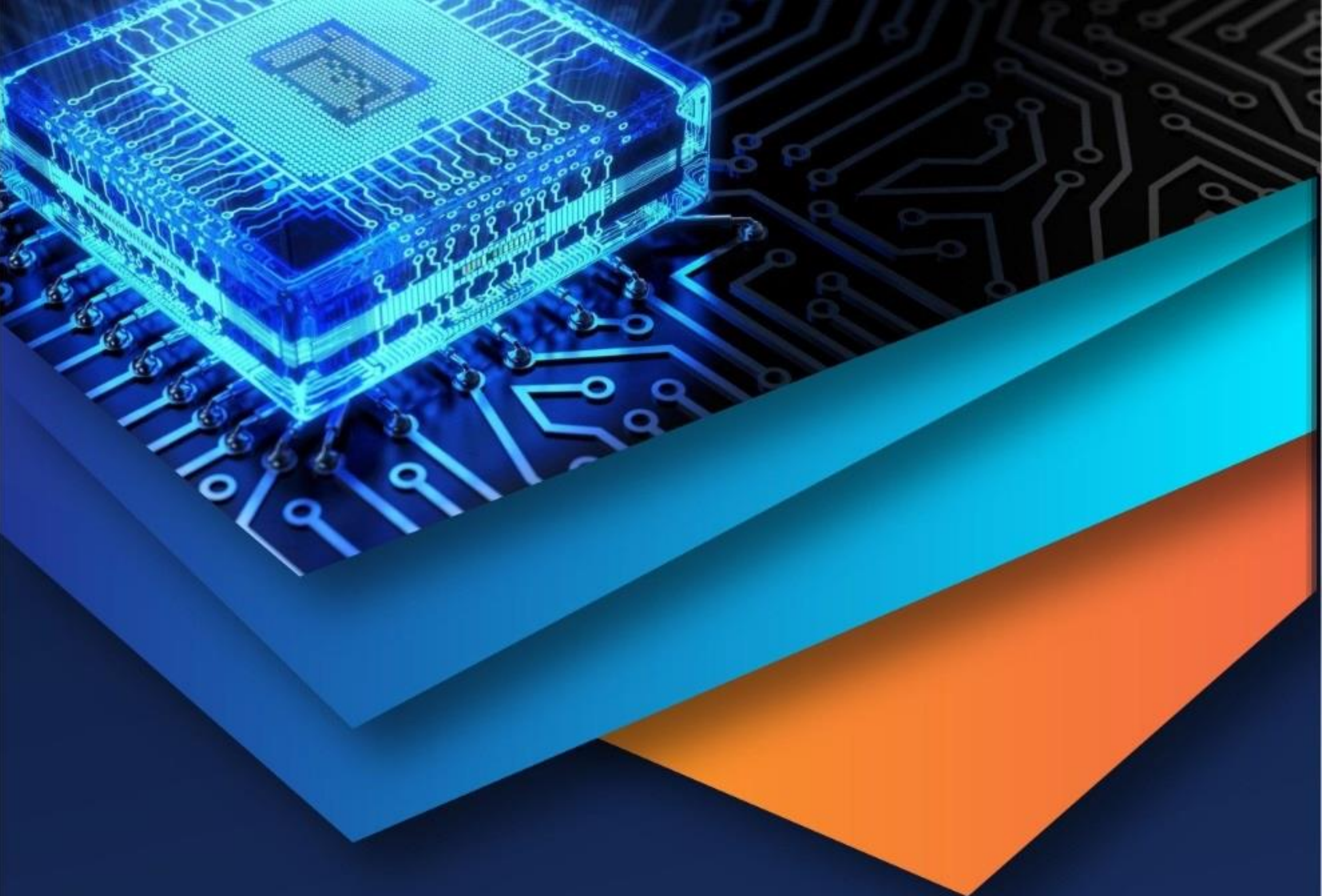

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